User manual

ADA-401WP

1-WIRE to MODBUS-RTU Measuring Module

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1. GENERAL INFORMATION

Thank you for your purchase of **CEL-MAR Company** product. This product has been completely tested and is covered by a two year warranty on parts and operation from date of sale.
If any questions or problems arise during installation or use of this product, please do not hesitate to contact Technical Support at +48 41 362-12-46 or e-mail support@cel-mar.pl.

1.1. WARRANTED INFORMATION

ADA-401WP module is covered by a two year warranty from date of sale. The warranty does not cover damage caused from improper use, materials consumption or any unauthorized changes. If the product does not function (is damaged), or not operate in accordance with the instructions will be repaired.
All warranty and no warranty repairs must be returned with paid transport and insuring to the **CEL-MAR Company.**
CEL-MAR Company under no circumstances won't be responsible for ensuing damage from improper using the product or as a result of random causes: the lightning discharge, the flood, the fire and the like.
CEL-MAR Company is not be held responsible for damages and loss including: loss of profits, loss of data, pecuniary losses ensuing from using or the impossibility of using this product.
In specific cases **CEL-MAR Company** discontinue all warranties and in particular do not follow the user manual and do not accept terms of warranty by the user.

1.2. GENERAL CONDITIONS FOR SAFE USE

The device should be installed in a safe and stable places (eg, electroinstallation cabinet), the powering cable should be arranged so as not to be exposed to trampling, attaching, or pulling out of the circuit.
Do not put device on the wet surface.
Do not connect devices for nondescript powering sources,
Do not damage or crush powering wires.
Do not make connection with wet hands.
Do not adapt, open or make holes in casings of the device!
Do not immerse device in water or no other liquid.
Do not put the fire opened on device sources: candles, an oil lamps and the like.
Complete disable from the supply network is only after disconnecting the power supply circuit voltage.
Do not carry out the assembly or disassembly of the device if it is enabled. This may result to short circuit and damage the device.
The device can not be used for applications that determine human life and health (eg. Medical).

1.3. CE LABEL

The CE symbol on the device CEL-MAR means compatibility with electromagnetic compatibility Electromagnetic Compatibility Directive **EMC 2014/30/WE.** Declaration of Conformity is available by contact with Technical Service (email: support@cel-mar.pl; phone: +48 41 362-12-46)..

1.4. ENVIRONMENTAL PRESERVATION

This sign on the device inform about putting expended device with other waste materials. Device should send to the recycling. (In accordance with the act about the Electronic Appliance Expended from day 29 of July 2005)

1.5. SERVICE AND MAINTENANCE

The **ADA-401WP module** does not require the servicing and maintenance.
Technical support is available at number +48 41 362-12-46 in 8.00-16.00, from Monday to Friday or e-mail support@cel-mar.pl.

1.6. PACK CONTENTS

Module is delivered with: User Manual, Line terminators 120W (2 pcs), CD-ROM with ADAUtil software.

2. PRODUCT INFORMATION

2.1. PROPERTIES

- Possibility of creating networks on the basis of RS485 bus to which are being connected 1-wire sensors,
- 1-WIRE to MODBUS-RTU protocol conversion,
- Supporting 1-WIRE interface circuits: DS1820, DS18S20, DS18B20, DS1822, DS2438Z, DS2401.
- Temperature, humidity and atmospheric pressure measurement from the 64 digital sensors,
- 300m 1-WIRE bus distance - depend on sensor's number and connection method of them and cables,
- Accuracy dependent on sensor's selection: for DS1820, DS18S20 – 0,50°C; for DS18B20, DS1822 – 0,0625°C,
- RS-485 network baud rate up to 230,4 kbps,
- 1-WIRE network baud rate: Standard up to 16,3 kbps, Overdrive up to 142 kbps,
- Stable power supply 10-30 VDC, power consumption up to 3W, depend on sensors number and type,
- 3kV= galvanic isolation between RS-485 interface and power supply,
- ~3kV= opto-isolation in signal channel between RS-485 and 1-WIRE interface,
- Protection against power supply reverse connection,
- Integrated short circuit protection and over-voltage protection on RS-485 and 1-WIRE networks,
- Screw terminal block connectors for all connections,
- DIN 43880 standard - mounting in typical electro-installation unit,
- Rail mounting according to DIN35 / TS35 standard,
- Dimensions (W x D x H) 53mm x 62mm x 90mm.

2.2. DESCRIPTION

The use of 1 wire digital sensors eliminates the influence of cable length on the measurement process that usual affects analog methods of temperature, humidity or pressure measurement and signal processing. Digital sensors transmit the measure value by data transfer protocol and this simplifies connection wiring of a large number of sensors and improves the detection of faulty components. Traditionally, it has been difficult to operate 1-WIRE data bus sensors in industrial environments. The solution to this problem is ADA-401WP addressable measurement module with MODBUS-RTU protocol. The ADA-401WP is robust and modular in design to operate 1-WIRE sensors in a industrial controller environment.
Using ADA-401WP as a addressable node of 1-WIRE bus lets extend the distance up to 1200m between 1-WIRE devices and PC with monitoring software e.g. SCADA or other MASTER type device (PLC controller). ADA-401WP is equipped with a screw terminal blocks for twisted pair connections 1-Wire bus and RS-485, as well as for power. Overvoltage protection on each RS-485 line is made on the basis of 600W protectors diodes and fuses. To RS485 Bus can be connected 32 devices ADA-401WP.Additional converter like ADA-I1040 (RS232 to RS485) or ADA-I9140 (USB to RS485) enables monitoring of the modules via RS232 or USB interface of PC with software as AdaUtil or SCADA.
Using:
- the ADA-4040 repeater to connect another 32 modules and extend RS485 bus up to 1200m,- the ADA-4044H HUB RS485, to connect up to 128 modules, change RS485 bus topology from linear to star - Each arm of the star can have length 1200 meters
- ETHERNET to RS485 converter (ADA-13040) or Wi-Fi to RS485/422 converter (ADA-14040) you can connect ADA-401WP modules of any location to monitoring or controlling systems.
The ADA-401WP offers a low power wide input voltage range from an external source of greater than 10V to a maximum of 30V and can be delivered from power pack (e.g. DR-15-12). The module has built in reverse polarity protection to protection against opposite polarization of power supply.

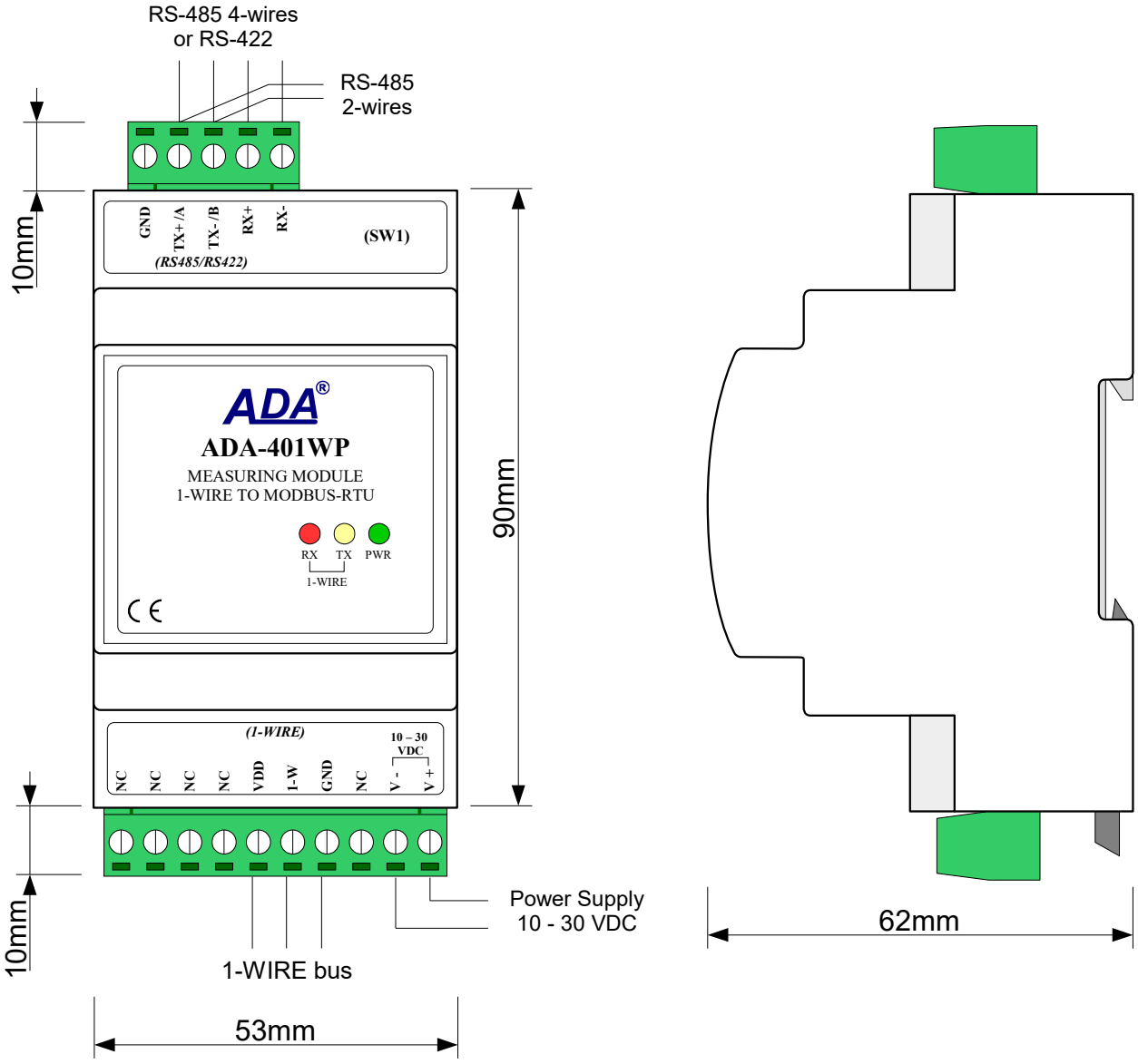

Fig. 1. ADA-401WP view

2.3. APPLICATION

ADA-401WP measurement module is ideal for applications involving:
- multi-point temperature registration and control,
- controlling of functioning of air-conditioning and heating
- temperature monitoring for HACCP norm,
- temperature monitoring in cereal silo, storehouses, cold stores, drying rooms,
- intelligent buildings.

2.4. ISOLATION

ADA-401WP has 2-way 3kV= galvanic isolation.

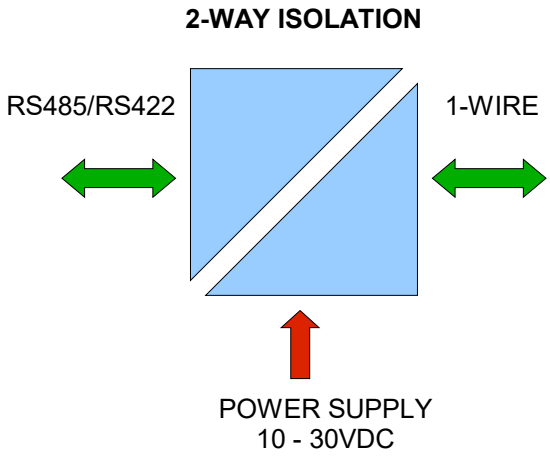

Fig 2. Isolation structure in ADA-401WP

3. INSTALLATION

This chapter will show how to use and connect ADA-401WP to computer, RS485/RS422 networks, 1-WIRE network and power supply. In the purpose of minimization of disruptions from environment is being recommended to:
- apply multipair type shielded cables, which shield can be connected to the earthing on one end of the cable,
- arrange signal cables in the distance not shorter than 25 cm from powering cables.
- apply cable for the power of adequate cross-section due to voltage drops for converter powering,
- not supply converter from power circuit device that generates large impulse interference such as transmitters, contactors,

3.1. ASSEMBLING

ADA-401WP enclosure is adapted to assembly on TS-35 (DIN35) rail. To install should be mounted device on the rail, upper part of the enclosure, then press bottom part to hear characteristic „Click” sound.

3.2. CONNECTION TO COMPUTER

Use a RS232 to RS485 converter (like ADA-I1040), or USB to RS485 (like ADA-I9140) to connect ADA-401WP module to computer. Fig.3 and Fig.4 (below) shows example connection.

3.3. CONNECTION TO RS485 / RS422 NETWORK

It is possible to connect 32 devices to RS485 network according to EIA-485 standard with total cable length of 1200m. To extend length of the network or increase the number of device should be used repeater or hub eg. ADA-4040, ADA-4044H.
Typical connections of ADA-401WP to RS485 network are shown on figure below.

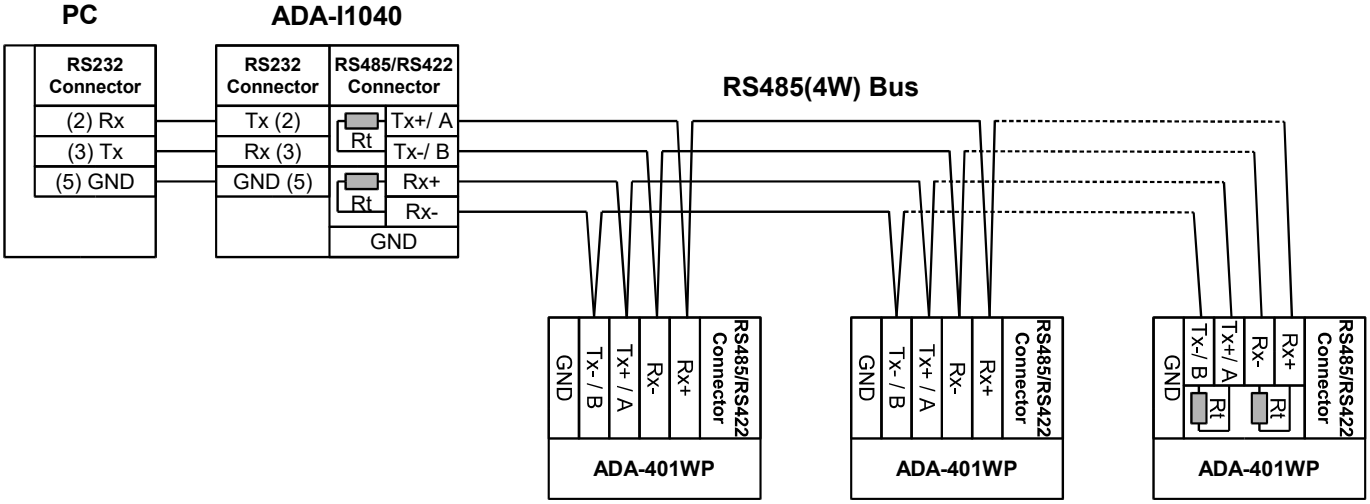

Fig 3. Example connection to RS485 4-wire network

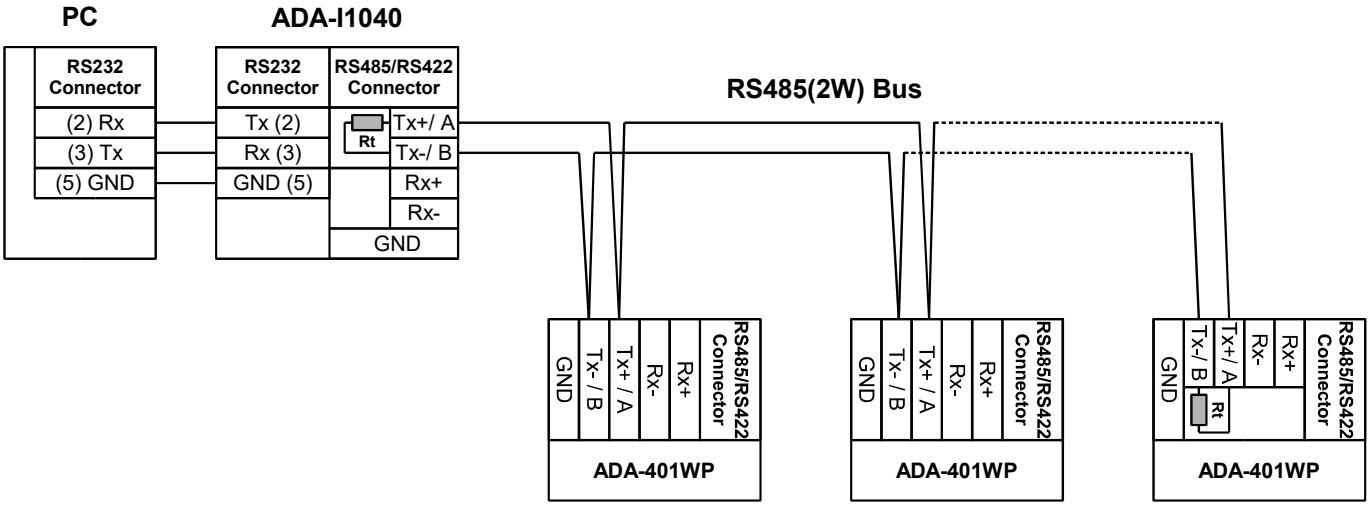

Fig 4. Example connection to RS485 2-wire network

3.3.1. GND TERMINAL CONNECTION

Connection of GND terminals of RS485/422 interfaces, devices connected to RS485/422 bus, should be done in the case of a potential difference of the signals grounds on interfaces RS485 / RS422, which prevents proper data transmission.
Cannot connect to the GND terminal - cables screens, PE circuit of electrical installation, signals grounds of other devices.

3.3.2. LINE TERMINATION

Using Line Termination (terminator) Rt = 120Ω will reduce electrical reflection in data line at high baud rate. It is not needed below 9600Bd. Should be used Line Termination resistor if the distance is over 1000m @ 9600Bd or 700m @ 19200Bd transmission. Example connection of Rt (connected to screw terminal block of RS485/422 interface) are shown on Fig. 3 & 4.

3.4. CONNECTION TO 1-WIRE NETWORK

3.4.1. CONNECTION TEMPERATURE SENSORS

Connections of 1-wire temperature sensors to ADA-401WP module are shown below.

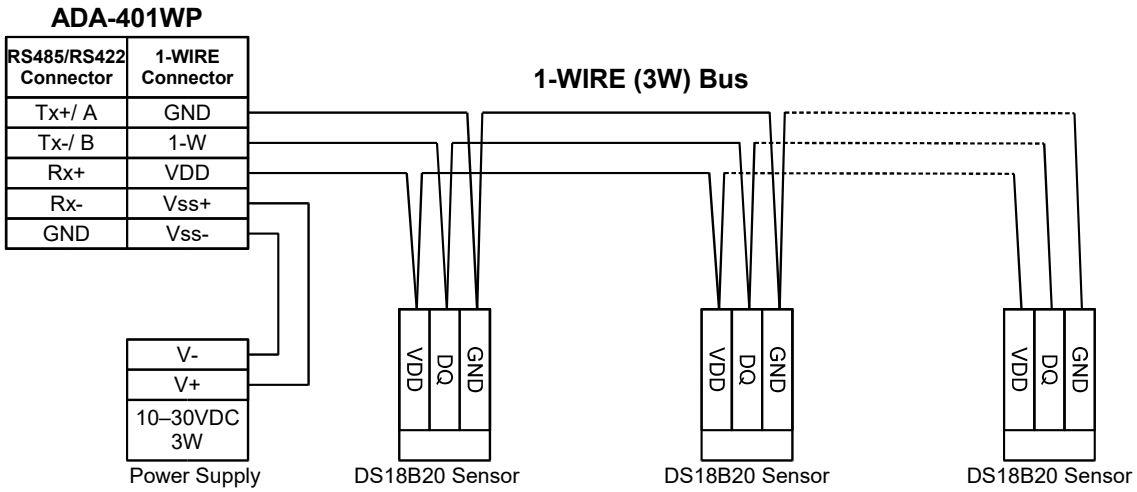

Fig 5. Sensor connection to ADA-401WP module with (3-wire) 1-WIRE network

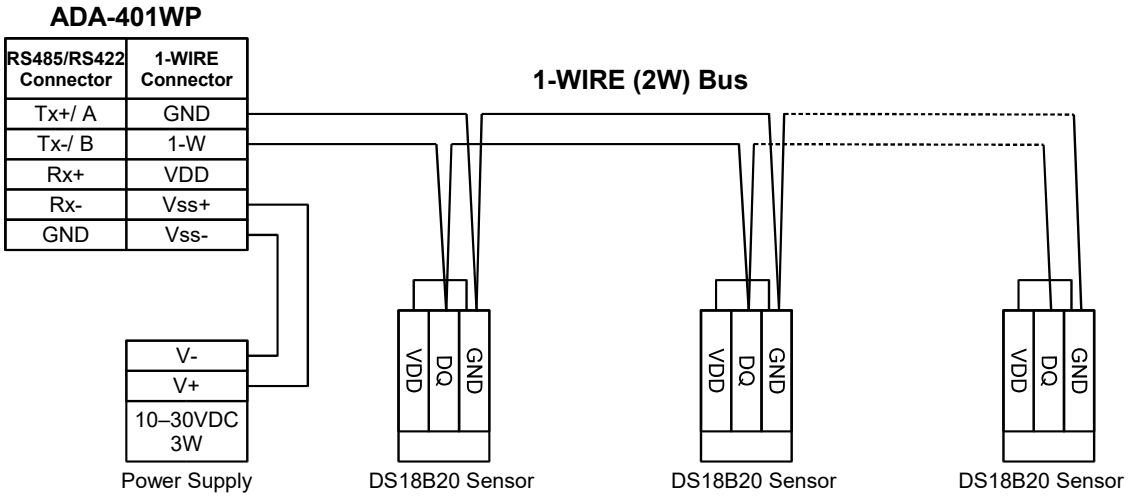

Fig 6. Sensor connection to ADA-401WP module with (2-wire) 1-WIRE network

3.4.2. SUPPORTED SENSORS WITH 1-WIRE INTERFACE

To ADA-401WP module can be connected devices like :

– based on circuits: DS1820, DS18S20, DS18B20, DS1822, DS2438Z, DS2401,
– temperature sensors DTS-103 & DTS107,
– environmental parameter sensor DES-200 (temperature, relative humidity, atmospheric pressure),
– environmental parameter sensor DES-216 (temperature, relative humidity, atmospheric pressure, lighting),
– environmental parameter sensor DES-300 (temperature, relative humidity, atmospheric pressure, lighting, sunlight, CO2 concentration),
– PT100 sensor to 1-WIRE converter DES-216-PT100,
– PT500 sensor to 1-WIRE converter DES-216-PT500,
– PT1000 sensor to 1-WIRE converter DES-216-PT1000,
– Analog signal 0-10V DC to 1-WIRE converter DES-216-U,
– Analog signal 0-20mA DC to 1-WIRE converter DES-216-I,

Method of connection above sensors to ADA-401WP is shown in user manuals of above devices.

3.4.3. SUPPORTED CIRCUITS WITH 1-WIRE INTERFACE

ADA-401WP module supports 1-WIRE interface circuits like: DS1820, DS18S20, DS18B20, DS1822, DS2438Z, DS2401.
In preparation DS2401 circuit.

3.4.4. 1-WIRE NETWORK LIMITATION

The maximum length of 1-WIRE network as layouts producer can be even 400m and the maximum number of sensors can be 500. However, when building the network, remember that, each sensor is a shortening of 0,5 meters and 100 meters of cable causes additional capacity load data line 5nF increasing signal distortion.
The real 1-WIRE network length and number of sensors will be less and will depend on:
– type of cables,
– topology connections,
– quality connections,
– interference from external electromagnetic fields.

RECOMMENDATIONS :
– **using one type of the cable, we recommend computer twisted cables UTP 4x2x0,5, for 1-WIRE bus,**
– **1-WIRE network connection in linear topology or use the passive 1-WIRE network splitter DNB-400,**
– **ending the 1-WIRE network by sensor,**
– **connecting unused wires and screen cable to PE rail of electrical installation.**
– **powering ADA-401WP module from individual power supply.**

3.5. POWER SUPPLY CONNECTION

The power supply to ADA-401WP module should be DC (regulated) from 10 V to 30V and minimum nominal power should be 3W, e.g. ZS-12/250 or DR-15-12. Power cable from DC power supplies to device must not be longer than 3m.
Observe the polarity, connect positive (+) of DC power supplies to V+ and negative (-) end to V- terminal. ADA-401WP has the protection from opposite connection power supply. If after power, on the front panel is not lit green LED PWR, check the power connection (polarity).

4. ACTIVATION

After properly connection according to section above the module can be powered. Once activated the green LED PWR on front panel of the module should light. If after connection power supply LED will not light green, check the correctness of connecting power supply. When data is present on the 1-WIRE bus the Tx and Rx LED should blink. A summary table of LED indications is listed below.

LED	***Description***
PWR	Signalization of Power Supply
Rx	Signalization of data transmission from ADA-401WP through 1-WIRE interface
Tx	Signalization of data receiving by ADA-401WP from 1-WIRE interface

4.1. ERRORS SIGNALIZATION

When works ADA-401WP module, may signal a short sound for different types of errors like:
- errors of sensors searching,
- errors of reading temperature from sensors,
- errors in RS485 communication,
- errors of CRC sensors serial number,
- short circuit on 1-WIRE network,
- no sensor,
- no 1-WIRE network controller.

The reasons of those errors can be found in ADAUtil software, checking:

- RS485 interface Diagnosis,
- 1-WIRE interface Diagnostic,
- System Diagnostic,
- Measurement channels Diagnostic

5. CONFIGURATION

Configuration of ADA-401WP module should be made by the use of **ADAUtil software** – delivered whit the module.
To make configuration, connect ADA-401WP to a PC (according to point ***CONNECTION TO COMPUTER)*** and be the power. If after power, on the front panel is not lit green LED PWR, check the power connection (polarity).
Once powered correctly, the module must be set to configuration mode by the use of the switch SW1, as shown in the table below.

SW1-1	***SW1-2***
ON	OFF

Yellow LED will blink with frequency 1 Hz. The yellow LED is located alongside the SW1 switch, under the upper terminal block connector cover.

5.1. OPERATING MODES

All available modes are shown in table below:

SW1- 1	***SW1- 2***	***Mode***
OFF	OFF	Run (Modbus)
OFF	ON	Factory Default (see chapter *FACTORY DEFAULT*)
ON	OFF	Configuration, Firmware Update (see chapter *FIRMWARE UPDATE)*
ON	ON	Emergency Firmware Update (see chapter *EMERGENCY FIRMWARE UPDATE*.)

To select operating mode, the SW1 micro-switch should be set in correct position. This micro-switch is available after removing upper terminal block cover (Fig. 1).

5.2. GENERAL CONFIGURATION

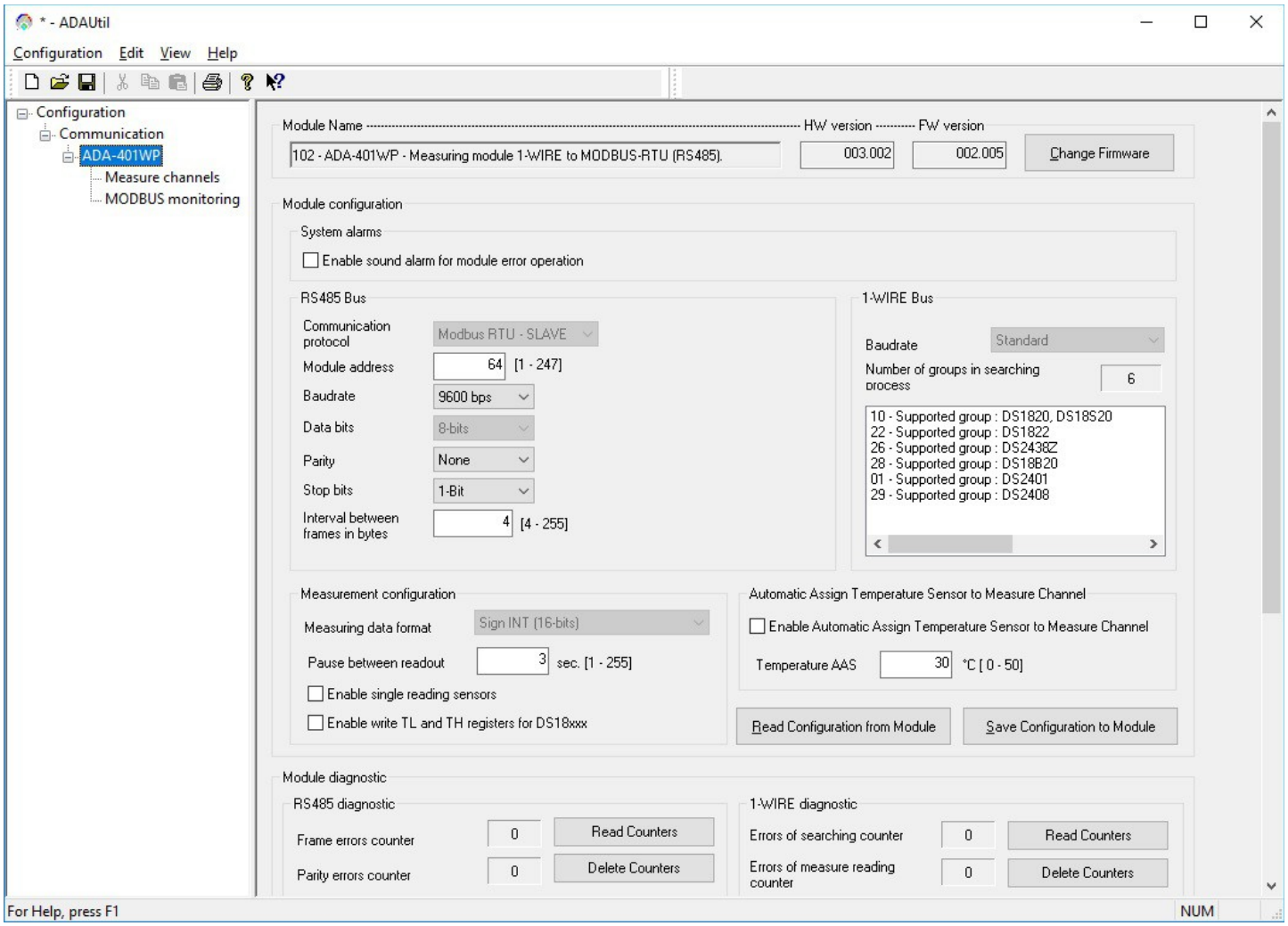

Fig 7. View of general configuration ADAUtil window

Main configuration is started by setting SW1 micro switch in configuration mode as follows:

SW1-1	***SW1-2***
ON	OFF

Yellow LED will blink with frequency 1 Hz.
Run ADAUtil software and select branch **Configuration=>Communication** on left panel and on right select COM port used for module configuration. Then select branch **Configuration=>Communication=>ADA-401WP** on left panel and on right press **[Read Configuration form Module]**. Set the parameters in the following sections.

5.2.1. SYSTEM ALARMS

Section **System Alarms** has option:
Enabling sound alarm for module error operation – enable or disable (disable - manufacturer setting).
Errors that are signalled by short sound:
– errors of sensors searching,
– errors of reading temperature from sensors,
– errors in RS485 communication,
– errors of CRC sensors serial number,
– short circuit on 1-WIRE bus,
– no sensor,
– no 1-WIRE bus controller.

5.2.2. RS485 CONFIGURATION

Section **RS485 bus has options:**
– **Communication Protocol** - allows choice of protocol (at the moment available - MODBUS RTU-SLAVE)),
– **Module address** – setting module address for selected protocol from range 1 to 247 (64 - manufacturer setting),
– **Baud rate**: 300bps – 230400bps (9600bps – factory default),
– **Data bits number:** 8 bits (readout only),
– **Parity control:** none, even parity, different parity, (non – factory default),
– **Stop bits number**: 1-bit or 2-bits (1-Bit – factory default),
– **Interval between frames in bytes:** 4 – 255, for MODBUS RTU protocol 4-character – factory default.

5.2.3. 1-WIRE CONFIGURATION

Section **1-WIRE bus** has options**:**
– **Baud rate**: standard (at the moment available is standard baud rate),
– **Number of groups in searching process***:* readout only,
– **List of available group of 1-WIRE sensor/systems in searching process** (readout only).

5.2.4. MEASUREMENT CONFIGURATION

Section **Measurement configuration** has options:
– **Measuring data format:** integral number with 2-byte (readout only),
– **Pause between readout:** interval between another readout of measurement from connected sensors - range 1 – 255 sec.
– **Enable single reading sensors:** enable this option causes that each sensor is readout separately. The time of readout one sensor is about 1 sec.
The effect of this option is:
- extension measurement readout time from sensors,
- reducing current value, being in VDD line or DQ, to current value one sensor in time of measurement processing. It is imported in potentially explosive environments, after connection an intrinsically safe barrier to ADA-401WP.
– **Enable write TL and TH registers for DS18xxx:** enable this option causes that change of Lo and Hi values in the configuration on measurement channel is write in TL and TH registers of DS18xxx sensor and readout from these registers. Disable this option causes that Lo and Hi values setted in the measurement channel configuration are written to ADA-401WP memory and readout from there.

Options **Enable single reading sensors** and **Enable write TL and TH registers for DS18xxx** are available from 2,005 firmware version and 1.7.1.0 version of ADAUtil.

5.2.5. AUTOMATIC ASSIGN SENSORS TO MEASUREMENT CHANNELS (AAS) CONFIGURATION

AAS function lets quickly assign sensors to measuring channels in the order specified by their heating temperature AAS. Description of using the AAS function is described in point ***CHANGING SENSORS ORDER BY THE USE OF AAS PROCEDURE***

Configuration of **AAS function :**
- **Enable Automatic Assign Temperature Sensor to Measure Channel**: enable or disable module AAS function,
- **Temperature AAS***:* 0 – 50 °C, - setting of AAS temperature above followed by automatic assignment of the sensor to a channel.
After configuration press button **Save configuration to module**.

Set SW1 switch section to run mode as in the table below.

SW1-1	***SW1-2***
OFF	OFF

Yellow LED will be OFF.

5.3. MEASURING CHANNEL CONFIGURATION

Set the SW1 micro switch in the configuration mode as table below

SW1-1	***SW1-2***
ON	OFF

Yellow LED will blink with frequency 1 Hz.

5.3.1. SENSOR ADDING

After connecting sensors to ADA-401WP, according to point ***CONNECTION TEMPERATURE SENSORS*** and running **ADAUtil software**, select branch **Configuration=>Communication** on left panel, and on right select COM port used for module configuration. Then on left panel select branch ***Configuration*=>*Communication*=>ADA-401WP=>Measure channels** and on right will open **[Measure channels configuration and diagnostic]** and press [**Read Configuration form Module] –** readout the configuration of measurement channels from ADA-401WP.

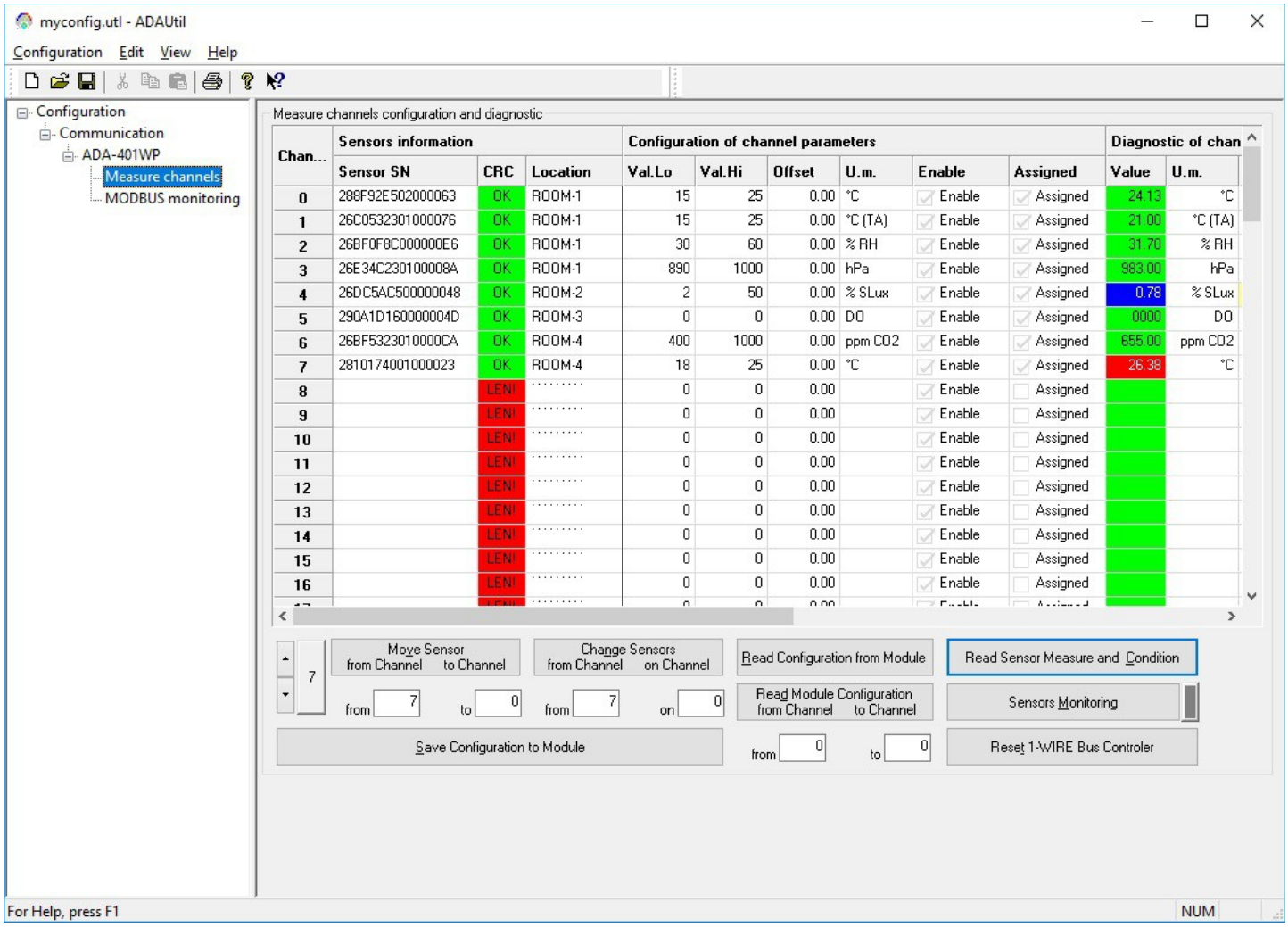
myconfig.utl - ADAUtil
Configuration Edit View Help
Configuration
Communication
ADA-401WP
Measure channels
MODBUS monitoring
Measure channels configuration and diagnostic
Chan...
Sensors information
Sensor SN
CRC
Location
Configuration of channel parameters
Val.Lo
Val.Hi
Offset
U.m.
Enable
Assigned
Diagnostic of chan
Value
U.m.
0 288F92E502000063 OK ROOM-1 15 25 0.00 °C Enable Assigned 24.13 °C
1 26C0532301000076 OK ROOM-1 15 25 0.00 °C (TA) Enable Assigned 21.00 °C (TA)
2 26BF0F8C000000E6 OK ROOM-1 30 60 0.00 % RH Enable Assigned 31.70 % RH
3 26E34C230100008A OK ROOM-1 890 1000 0.00 hPa Enable Assigned 983.00 hPa
4 26DC5AC500000048 OK ROOM-2 2 50 0.00 % SLux Enable Assigned 0.78 % SLux
5 290A1D160000004D OK ROOM-3 0 0 0.00 DO Enable Assigned 0000 DO
6 26BF5323010000CA OK ROOM-4 400 1000 0.00 ppm CO2 Enable Assigned 655.00 ppm CO2
7 2810174001000023 OK ROOM-4 18 25 0.00 °C Enable Assigned 26.38 °C
8 LEN! 0 0 0.00 Enable Assigned
9 LEN! 0 0 0.00 Enable Assigned
10 LEN! 0 0 0.00 Enable Assigned
11 LEN! 0 0 0.00 Enable Assigned
12 LEN! 0 0 0.00 Enable Assigned
13 LEN! 0 0 0.00 Enable Assigned
14 LEN! 0 0 0.00 Enable Assigned
15 LEN! 0 0 0.00 Enable Assigned
16 LEN! 0 0 0.00 Enable Assigned
Move Sensor from Channel to Channel
Change Sensors from Channel on Channel
Read Configuration from Module
Read Sensor Measure and Condition
from 7 to 0
from 7 on 0
Read Module Configuration from Channel to Channel
Sensors Monitoring
Save Configuration to Module
from 0 to 0
Reset 1-WIRE Bus Controler
For Help, press F1
NUM

Fig 8. View of ADAUtil measuring channel configuration window

After readout the configuration of measurement channels, serial numbers of all searched sensors will be presented in the column **Sensor SN**.

The numbers of channel are assigned in order of search by the module.
Correctly identified sensor is assigned the appropriate unit of measure in column **[U.m.]** as in the table below.

Table indications of sensors

Sensor	***Unit of measurement***	***Sensor***	***Unit of measurement***
Temperature	°C	voltage converter 0-10V DC	V U10
Relative humidity	%RH	current converter 0-2mA DC	mA A20
Atmospheric pressure	hPa	DS2401 circuit serial number	S/N
Lighting (natural or unnatural)	%Lux	Unrecognised sensor	???
Sunlight	%SLux		
Temperature adjuster	(TA)°C		
Percentage adjuster	(PA)%		
CO2 concentration (in preparation)	CO2 ppm		
Sensor transducer PT100 to 1-WIRE	°C PT100		
Sensor transducer PT500 to 1-WIRE	°C PT500		
Sensor transducer PT1000 to 1-WIRE	°C PT1000		

If before readout the configuration of measure channels, were not connected temperature sensors to the module, the list of the column **[U.m.]** will be empty. In this case, connect sensor (s) to ADA-401WP and again readout the configuration of measurement channels from ADA-401WP memory, by pressing [**Read Configuration form Module]**.

Adding next sensors, consist in connecting them to the module and readout the configuration of measurement channels from ADA-401WP memory, by pressing [**Read Configuration form Module]**.

ATANTION!!

If wish to new added sensors were assigned to further measurement channels, should set ***Assigned*** for before added sensors, and save the channel configuration to the module by pressing **[Save Configuration to Module].**

After adding all sensors to the measurement channels, should be set an order of sensors and make the configuration of measurements channels as described below.

5.3.2. CHANGING SENSORS ORDER

The order of sensors can be changed by:
- sensor displacement,
- sensors exchange,
- AAS procedure.

All above method are described below.

5.3.2.1. SENSOR DISPLACEMENT

To displacement the sensor from one channel to the other, under button **Move Sensor from Channel to Channel,** enter to field **from** the number of channel from which the sensor will be moved and to field **to** enter the number of channel to which the sensor will be moved. Press the button **Move Sensor from Channel to Channel.**
Save the configuration to module memory by pressing button **Save Configuration to Module.**

To the module memory will be saved only configuration of measuring channels which fields were marked in ping.

5.3.2.2. SENSORS EXCHANGE

To exchange the sensors enter to the fields **from** and **on** the channel number to which will be exchange the sensors and press the button **Exchange Sensors from Channel on Channel**. Save the configuration to module memory by pressing button **Save Configuration to Module**.

To the module memory will be saved only configuration of measuring channels which fields were marked in ping.

5.3.2.3. CHANGING TEMPERATURE SENSORS ORDER BY THE USE OF AAS PROCEDURE

If the location of sensors in the installation is unknown, can be added to measurement channel by using **Automatic Assign Sensor** function.
The procedure of Automatic Assign Sensor (AAS) is made in the following steps:

1. Connect 1-WIRE sensors bus to ADA-401WP.
2. Select (in the ADAUtil software) branch **Configuration => Communication =>ADA-401WP** on left panel and on right press **Read Configuration form Module.**
3. In section **Automatic Assign Temperature Sensor to Measure Channel** select option **Enable Automatic Assign Temperature Sensor to Measure Channel,** then in edition field **Temperature AAS,** enter the upper temperature limit beyond which it will automatically assign a heated sensor to the measurement channel. The sensors are assigned sequentially to the channel number 0, 1, 2, 3 … e.t.c.
4. Press button **Save configuration to module.**
5. Select branch ***Configuration* => *Communication* =>ADA-401WP => Measure Channels** on left panel and on right press **Read Configuration form Module.**
6. After readout the configuration press **Sensors Monitoring.**
7. Then heat sensors in the selected order (e.g. as fig. below) and if sensor temperature exceeds the setted temperature AAS, sensor will be automatically assign for measuring channel. Any assignment of a sensor for measuring channel is indicated by the module and program of short tone/Beep.
8. This procedure is ended by pressing again the button **Sensors Monitoring.**
9. Select branch ***Configuration* => *Communication* =>ADA-401WP**, then in section **Automatic Assign Temperature Sensor to Measure Channel,** disable the option **Enable Automatic Assign Temperature Sensor to Measure Channel**.
10. Press button **Save Configuration to Module**. It will disable the algorithm of **Automatic Assign Sensor to Measuring Channel** in ADA-401WP module.

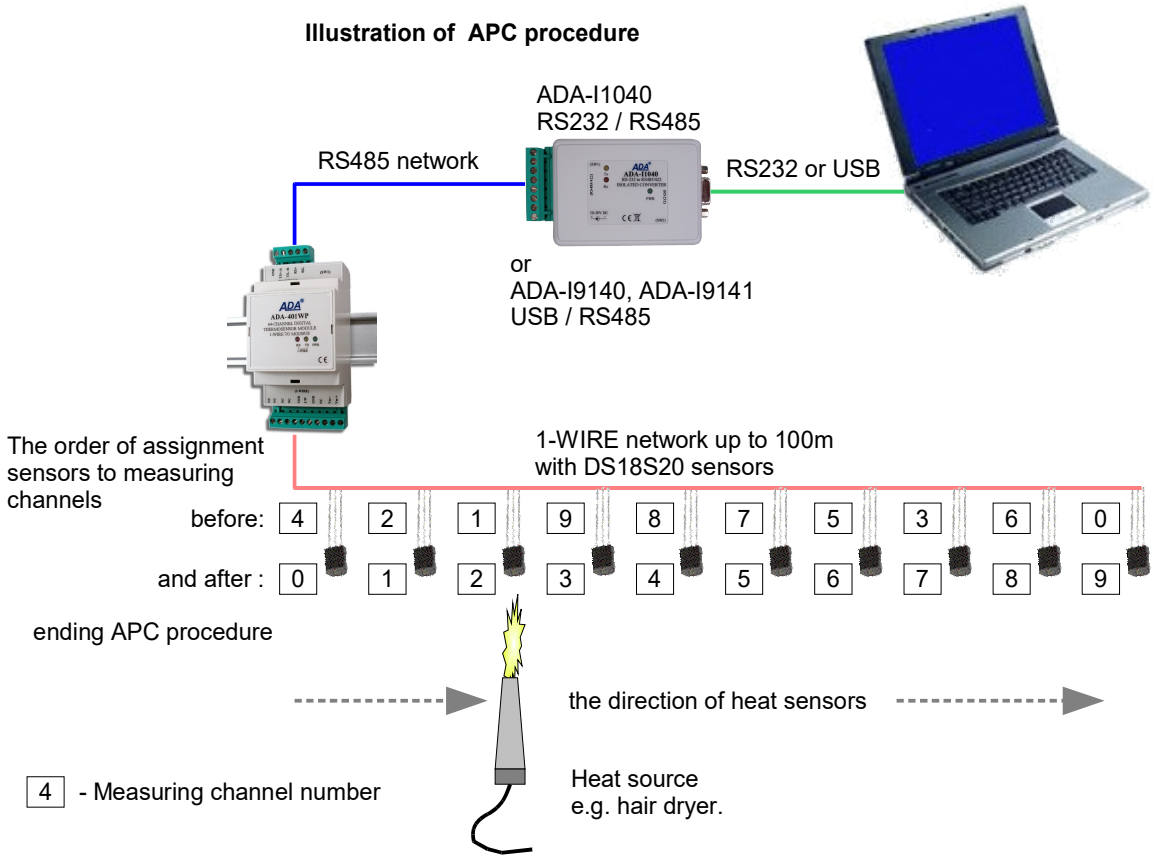
Illustration of APC procedure
ADA-I1040
RS232 / RS485
RS485 network
RS232 or USB
or
ADA-I9140, ADA-I9141
USB / RS485
The order of assignment sensors to measuring channels
1-WIRE network up to 100m with DS18S20 sensors
before: 4 2 1 9 8 7 5 3 6 0
and after : 0 1 2 3 4 5 6 7 8 9
ending APC procedure
the direction of heat sensors
4 - Measuring channel number
Heat source
e.g. hair dryer.

Fig 9. Visualization of I Automatic Assign Temperature Sensor to Measure Channel

5.3.3. SENSORS REMOVING

Double click on the field **Sensor SN** of channel, and press the **Delete** key of a keyboard and go to next field. Save the configuration to module memory by pressing button **Save Configuration to Module**.

To the module memory will be saved only configuration of measuring channels which fields were marked in ping.

5.3.4. MEASUREMENT CHANNEL PARAMETERS CONFIGURATION

After ended adding and changing sensors order, can be configured other parameters of measuring channels. Successively fill in fields:

Location – enter a location of installed sensors, maximum 9 characters.

Val.Lo – value of lower limit measure value. If the value measured by sensor will be lower, that will be setted the byte of exceed lower threshold V<VL in the register of measurement channel.

Val.Hi – value of high limit measure value. If the value measured by sensor will be higher, that will be setted the byte of exceed upper threshold V>VL in the register of measurement channel.

Offset – The value of which will be increased or decreased the value measured by the sensor measurement to a linear calibration measurement. The offset depends on the type of sensor:

- from -1.27°C to +1.27°C for digital temperature sensors DTS-RJ45, DTS-103, DTS-107, DES-300-T, DES-300E-T,
- from -12.70%Hig to +12.70%Hig for digital relative humidity sensors: DES-216-H, DES-300-H etc.,
- from -12.70hPa to +12.70hPa for digital atmospheric pressure sensors: DES-216-AP, DES-300-AP etc.

Enable – activation this field will cues actualisation of measurement and status for channel, deactivation will cues block actualisation.

Assigned - activation this field will cues adding a sensor to the Channel. Deactivation will cues that in case of next sensors searching by the module in field [Sensor SN] channel can be serial number or other sensor.

Each proper changing of the list's field of table **Measuring Channel Configuration** is causing highlighting of data of the measuring channel to the ping color.

Save the configuration to module memory by pressing button **Save Configuration to Module**.

To the module memory will be saved only configuration of measuring channels which fields were marked in ping.

Set the SW1 switch section to run mode as in the table below.

SW1-1	*SW1-2*
OFF	OFF

Yellow LED will be OFF.

5.4. SAVING TO FILE

Main configuration and measurement channel configuration can be saved to a configuration file. It lets to save the configuration of each measuring module of the system. Choose from menu **Configuration => Save** or **Save As,** and a window **Save As** will open (fig.10). Enter the file name in the field File Name and press button **Save**.

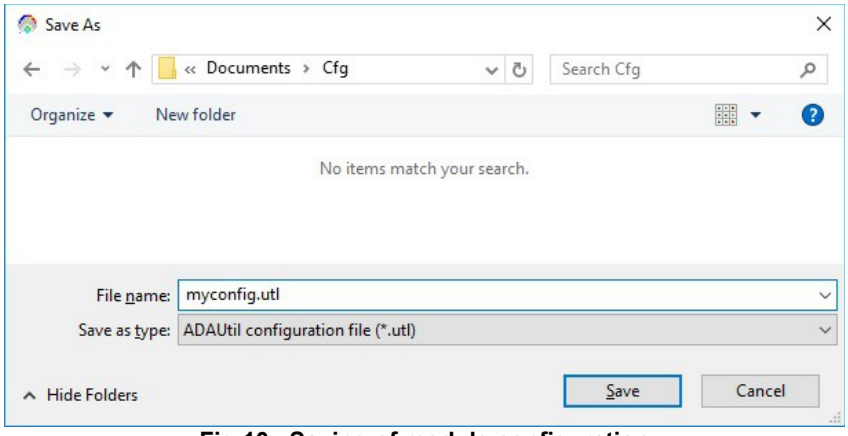

Fig 10. Saving of module configuration

5.5. PRINTING OF CONFIGURATION

To print the main configuration and measurement channels, select in left window the branch **Configuration => Communication => ADA-401WP => Measuring Channels** and then select from the menu **Configuration =>Print or Print View.**

5.6. FIRMWARE UPDATE

Set the SW1 micro switch to configuration mode – table below

SW1-1	***SW1-2***
ON	OFF

Yellow LED will blink with frequency 1 Hz (the yellow LED is located alongside the SW1 switch, under the upper terminal block connector cover).

Run **ADAUtil** software and select **Configuration => Communication** on left panel and on right select COM port used for changing software. Then select **Configuration => Communication => ADA-401WP** and press button **Change Firmware**, window will open in which should be selected and opened the *.bin. Software will be load to ***ADAUtil*** buffer storage and will be checked. If the **ADAUtil** not detect errors in loaded file, can be changed the module software. Process of software update is visualized by **ADAUtil** in use of Progress Window and after proper update confirmed by correct message.

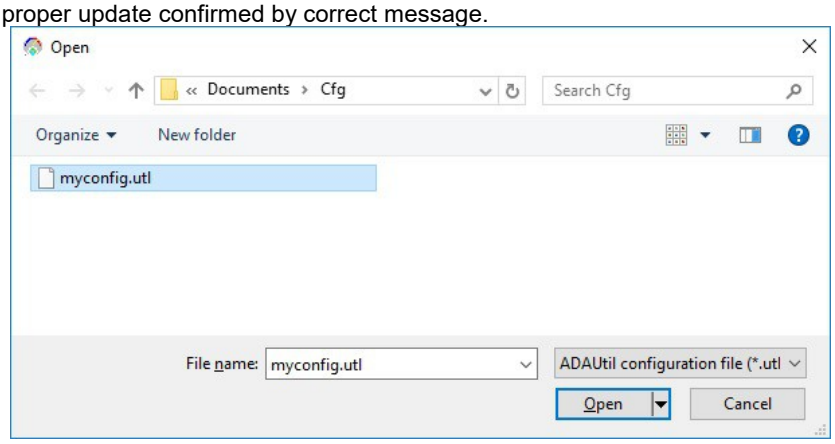

Fig. 11. Choice of software file

During loading software the yellow LED located beside SW1 micro-switch will blink, showing data flow to module. If the software loaded correctly yellow LED will be blink with frequency 1 Hz.

Attention! Do not turn off the power during the firmware updating.

After that set micro switch SW1 to run mode as shown in the table below.

SW1-1	***SW1-2***
OFF	OFF

Yellow LED will be OFF.

5.7. EMERGENCY FIRMWARE UPDATE

In the case of the unsuccessful update of the module software, try again according to description in point ***FIRMWARE UPDATE***. If the update is still incorrect use emergency firmware update.
Set the SW1 microswitch to Emergency Firmware Update mode as in the table below.

SW1-1	***SW1-2***
ON	ON

Restart the module by turning OFF, and after while, turning ON. The yellow LED will light continuously and the module will be in emergency software mode and now follow the description below:

Run **ADAUtil** software and select **Configuration => Communication** on left panel and on right select COM port used for changing software. Then select **Configuration => Communication => ADA-401WP** and press button **Change Firmware**, window will open in which can be selected and opened file *.bin. Software will be load to ***ADAUtil*** buffer storage and will be checked. If the **ADAUtil** not detect errors in loaded file, module software can be changed. Process of software changing is visualized by **ADAUtil** in use of Progress Window and after proper changing confirmed by correct message.

Attention! Do not turn off the power during the firmware updating.

After that set micro switch SW1 to RUN mode as shown in the table below.

SW1-1	***SW1-2***
OFF	OFF

Yellow LED will be OFF.

5.8. FACTORY DEFAULT

In the case, were the module has malfunction as a result of:
- missing communication in the configuration mode,
- value visualization of temperature measurement with the 0,5°C accuracy,
- transmission errors on the 1-WIRE bus,

restore factory default and reset register.

Set the SW1 microswitch as in the table below.

SW1-1	***SW1-2***
OFF	ON

Then turn off the power and after while, turn on the power of the module. After that to internal registers of the module will be loaded factory default.

After successful restart of module sw1 switch to RUN mode as in the table below.

SW1-1	***SW1-2***
OFF	OFF

6. DIAGNOSTICS

6.1. GENERAL MODULE DIAGNOSTICS

Set the switch SW1 to configuration mode as shown in the table below.

SW1-1	***SW1-2***
ON	OFF

Yellow LED will blink with frequency 1 Hz (the yellow LED is located alongside the SW1 switch, under the upper terminal block connector cover).

Start the **ADAUtil** software and in left window select branch **Configuration => Communication => ADA-401WP**.

In the following sections diagnostic module can be checked correctness of transmission data by RS458 and 1-WIRE interfaces and stability of functioning of module.

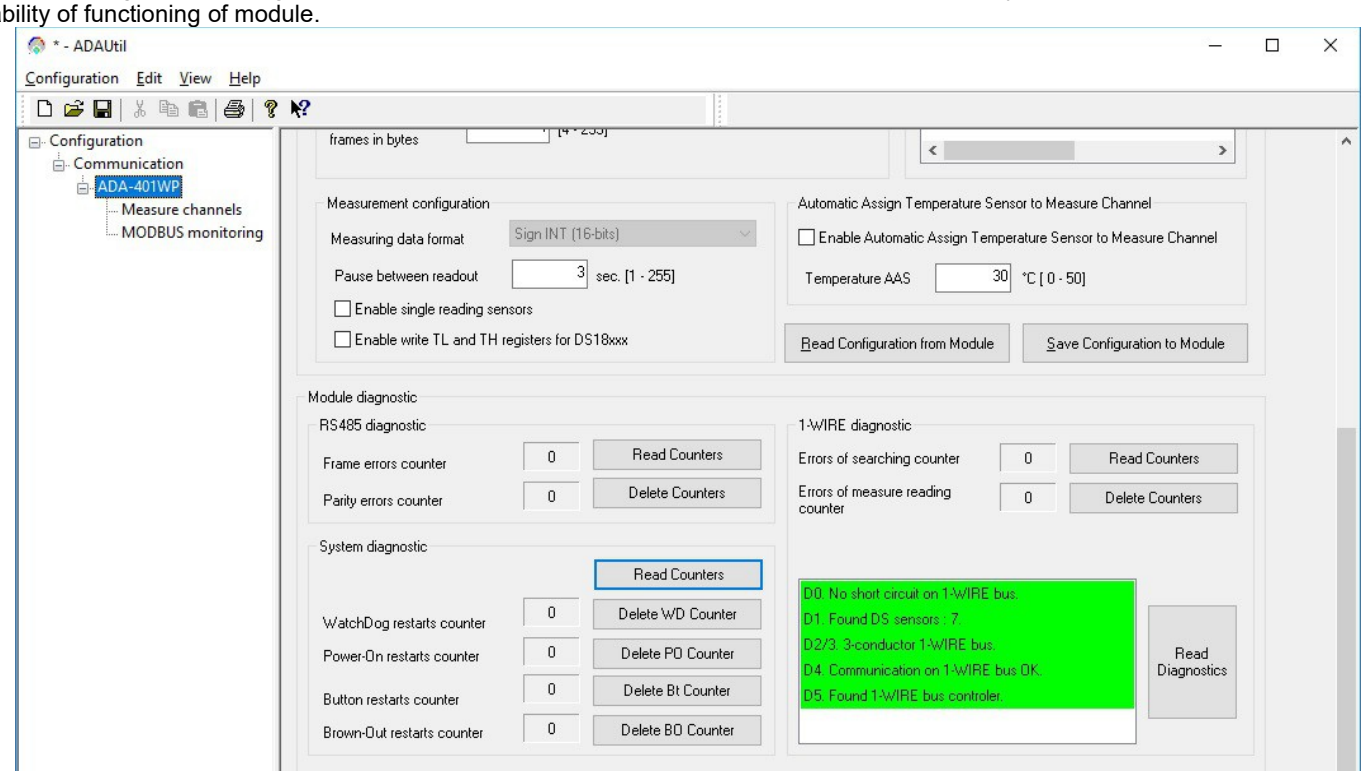

Fig 12. View of main diagnostics of module

6.1.1. RS485 INTERFACE DIAGNOSTICS

Frame errors counter and parity errors counters are refreshed pressing button **Read Counter.**
In order to reset the counter from module memory press button **Delete Counters**.
Frame errors counter - is increased e.g. errors from incorrect speed to actual speed of data transmitted.
Parity error counter – counts errors, which can be from bits corrupted in the transmitted character.

6.1.2. 1-WIRE INTERFACE DIAGNOSTICS

Errors encountered during searching for sensors and errors associated with readout measurements counter are refreshed by pressing button **Read Counter**.
To reset the counter in module memory press button **Delete Counter.**
Errors of searching counter - is increased in case of errors detected from sensor searching process on 1-WIRE network.
Errors of measuring reading counter - is increased in case of detection improper data in process of temperature reading.

6.1.3. ADDITIONAL DIAGNOSTICS OF 1-WIRE BUS

Press button **Readout Diagnostics** for:

- Short circuits on the network
- The number of detected sensors,
- Network types,
- Correctness's of communication,
- Detection of 1-WIRE bus converter.

6.1.4. SYSTEM DIAGNOSTICS

It is possible to readout a number of system counters (information about module operation) by pressing the button **Read Counters**.
Delete the counter in module memory individually of each e.g. **Delete WD Counter.**
Register counter of WatchDog –the number of restarts of the processor for program WatchDog.
Register counter of Power-On – the number of power cycles of the module.
Register counter of Button – the number of RST (Reset) button.
Register counter of Brown-On – specifies the number of the operating voltage drops below allowable voltage level

After that, can be set the switch section SW1 to RUN mode as in the table below.

SW1-1	***SW1-2***
OFF	OFF

Yellow LED will be OFF.

6.2. DIAGNOSTIC OF MEASUREMENT CHANNELS

After configuration the measurement channels can be carried out their diagnosis and verify communication on 1-Wire bus.
In the purpose of readout measurement channels diagnostic, set micro switch SW1 to configuration mode as shown in the table below.

SW1-1	***SW1-2***
ON	OFF

Yellow LED will blink with frequency 1 Hz.

Start ***ADAUtil* software** and select ***Configuration* => *Communication*** on left panel and on right select COM port used for changing software. Then select **Configuration => Communication => ADA-401WP => Measuring Channels,** and on right window press **Readout Configuration form Module.** Scroll on right, until to see the unit **Diagnostic of channels.** On the screen are the columns**:**

Value **-** measurement value readout from the sensor.
U.m. **-** unit of measurement measured by the sensor.
V<VL - indicates that the value readout from the sensor is short then the lower limit of the value **VL**.
V=>VH - indicates that the value readout from the sensor is equal to the lower limit of the value **VH**
Enable - indicates that the measurement channel is unblocked and measuring data and the status channel are being updating systematically.
Assigned - indicates that sensor of serial number was assigned to measuring channel.
Busy - indicates that sensor is processing data.
Detected - indicates that the sensor of serial number from field **Sensor SN** was detected.
CRC **-** indicates error of CRC sensor memory or connection error.

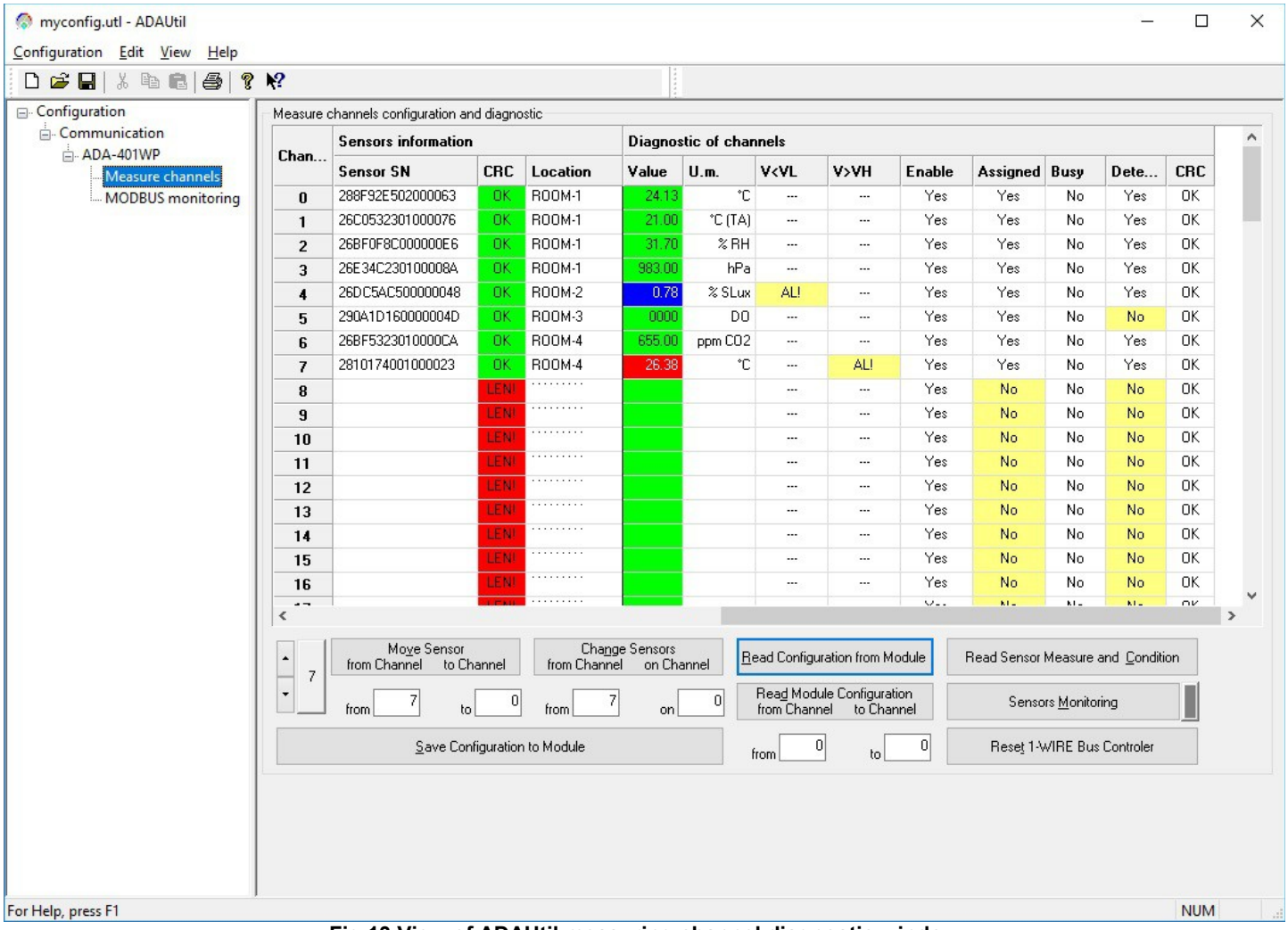
myconfig.utl - ADAUtil
Configuration Edit View Help
Configuration
Communication
ADA-401WP
Measure channels
MODBUS monitoring
Measure channels configuration and diagnostic
Chan...
Sensors information
Diagnostic of channels
Sensor SN
CRC
Location
Value
U.m.
V<VL
V>VH
Enable
Assigned
Busy
Dete...
CRC
0 288F92E502000063 OK ROOM-1 24.13 °C --- --- Yes Yes No Yes OK
1 26C0532301000076 OK ROOM-1 21.00 °C (TA) --- --- Yes Yes No Yes OK
2 26BF0F8C000000E6 OK ROOM-1 31.70 % RH --- --- Yes Yes No Yes OK
3 26E34C230100008A OK ROOM-1 983.00 hPa --- --- Yes Yes No Yes OK
4 26DC5AC500000048 OK ROOM-2 0.78 % SLux AL! --- Yes Yes No Yes OK
5 290A1D160000004D OK ROOM-3 0000 DO --- --- Yes Yes No No OK
6 26BF5323010000CA OK ROOM-4 655.00 ppm CO2 --- --- Yes Yes No Yes OK
7 2810174001000023 OK ROOM-4 26.38 °C --- AL! Yes Yes No Yes OK
8 LEN! --- Yes No No No OK
9 LEN! --- Yes No No No OK
10 LEN! --- Yes No No No OK
11 LEN! --- Yes No No No OK
12 LEN! --- Yes No No No OK
13 LEN! --- Yes No No No OK
14 LEN! --- Yes No No No OK
15 LEN! --- Yes No No No OK
16 LEN! --- Yes No No No OK
Move Sensor from Channel to Channel
Change Sensors from Channel on Channel
Read Configuration from Module
Read Sensor Measure and Condition
Read Module Configuration from Channel to Channel
Sensors Monitoring
Save Configuration to Module
Reset 1-WIRE Bus Controler
from 7 to 0
from 7 on 0
from 0 to 0
For Help, press F1
NUM

Fig 13.View of ADAUtil measuring channel diagnostic window

Readout of channels diagnostic and sensor measurement values by pressing the button **Read Sensor Measure and Condition.**

Continuous monitoring of measurement channels diagnostic and measuring value from sensors by pressing the button **Sensors Monitoring.**

Normal operating of 1-WIRE network :

- no corruption of CRC,
- all connected sensors are detected,
- no readout error temperature.

After that, can be set the switch section SW1 to RUN mode as in the table below.

SW1-1	***SW1-2***
OFF	OFF

Yellow LED will be OFF.

6.3. DIAGNOSTIC OF MODBUS PROTOCOL

After finishing diagnostic of measurement channels of each ADA-401WP module in installation, can be started diagnostic and checking of correctness MODBUS protocol communication on RS485 bus. The module should be in the RUN mode – the SW1 micro switch should be setted like in the table below.

SW1-1	***SW1-2***
OFF	OFF

Yellow LED will be OFF.

Start the **ADAUtil software** and in left window select branch **Configuration => Communication** on left panel, and on right select COM port used for MODBUS diagnostic. Then select **Configuration => Communication => ADA-401WP => MODBUS Monitoring,** on right will be window **MODBUS Monitoring.**

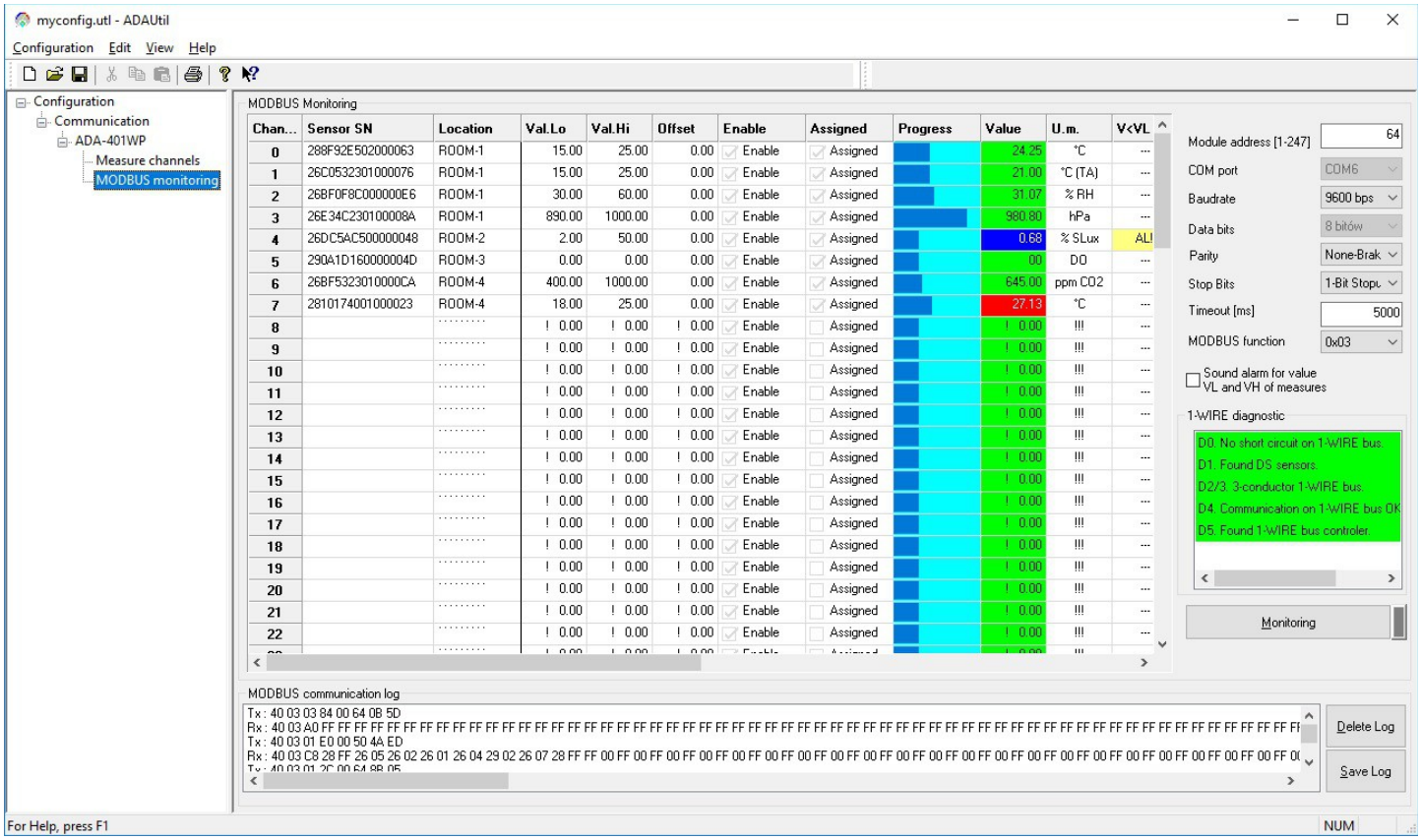
myconfig.utl - ADAUtil
Configuration Edit View Help
Configuration
Communication
ADA-401WP
Measure channels
MODBUS monitoring
MODBUS Monitoring
Chan... Sensor SN Location Val.Lo Val.Hi Offset Enable Assigned Progress Value U.m. V<VL
0 288F92E502000063 ROOM-1 15.00 25.00 0.00 Enable Assigned 24.25 °C
1 26C0532301000076 ROOM-1 15.00 25.00 0.00 Enable Assigned 21.00 °C (TA)
2 26BF0F8C000000E6 ROOM-1 30.00 60.00 0.00 Enable Assigned 31.07 % RH
3 26E34C2301000008A ROOM-1 890.00 1000.00 0.00 Enable Assigned 980.80 hPa
4 26DC5AC500000048 ROOM-2 2.00 50.00 0.00 Enable Assigned 0.68 % SLux ALI
5 290A1D160000004D ROOM-3 0.00 0.00 0.00 Enable Assigned 00 DO
6 26BF5323010000CA ROOM-4 400.00 1000.00 0.00 Enable Assigned 645.00 ppm CO2
7 2810174001000023 ROOM-4 18.00 25.00 0.00 Enable Assigned 27.13 °C
Module address [1-247] 64
COM port COM6
Baudrate 9600 bps
Data bits 8 bitów
Parity None-Brak
Stop Bits 1-Bit Stopu
Timeout [ms] 5000
MODBUS function 0x03
Sound alarm for value VL and VH of measures
1-WIRE diagnostic
D0: No short circuit on 1-WIRE bus.
D1: Found DS sensors.
D2/3: 3-conductor 1-WIRE bus.
D4: Communication on 1-WIRE bus OK
D5: Found 1-WIRE bus controler.
Monitoring
MODBUS communication log
Delete Log
Save Log
For Help, press F1
NUM

Fig 14a. View of MODBUS monitoring window – configuration parameters of channels

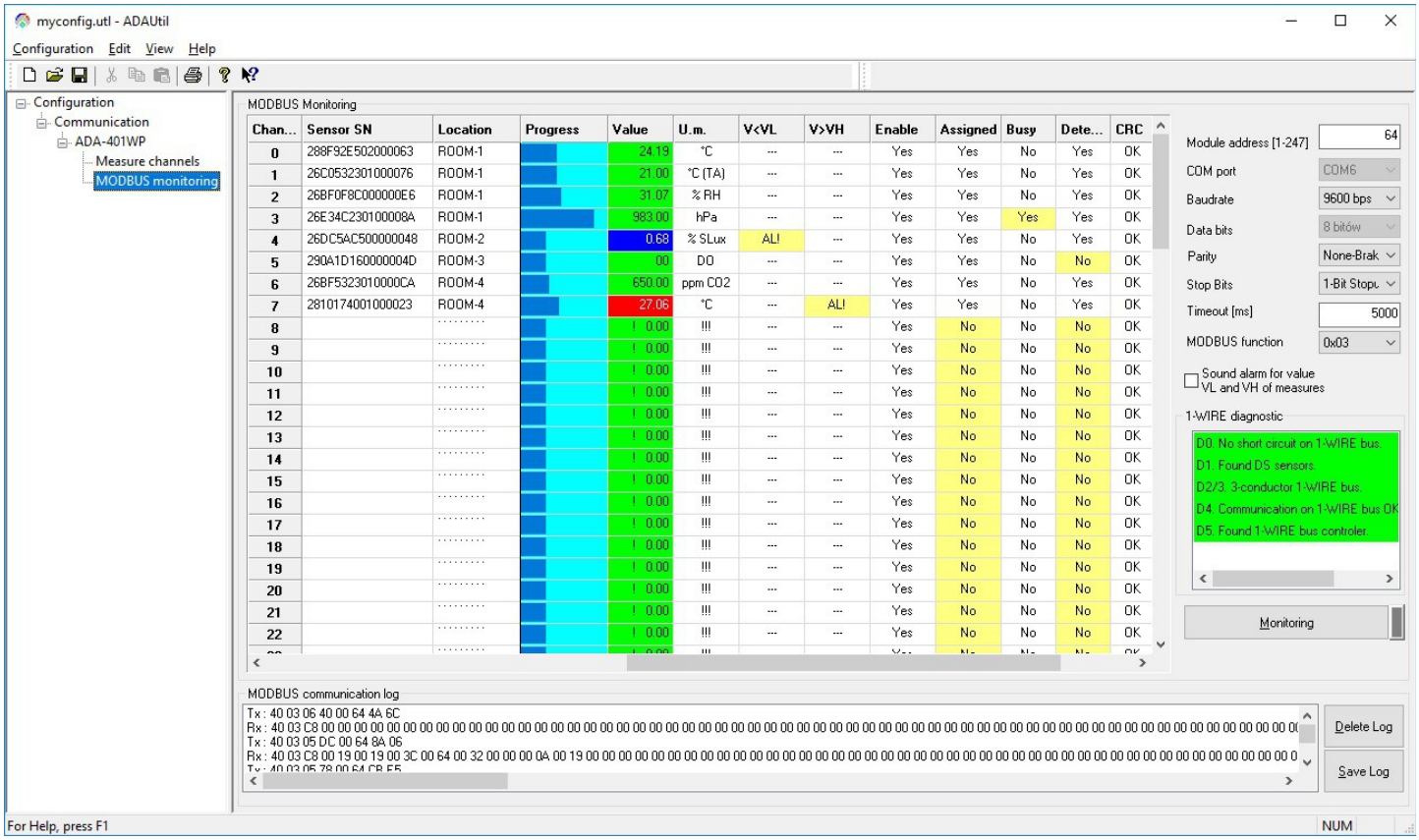
myconfig.utl - ADAUtil
Configuration Edit View Help
Configuration
Communication
ADA-401WP
Measure channels
MODBUS monitoring
MODBUS Monitoring
Chan... Sensor SN Location Progress Value U.m. V<VL V>VH Enable Assigned Busy Dete... CRC
0 288F92E502000063 ROOM-1 24.19 °C Yes Yes No Yes OK
1 26C0532301000076 ROOM-1 21.00 °C (TA) Yes Yes No Yes OK
2 26BF0F8C000000E6 ROOM-1 31.07 % RH Yes Yes No Yes OK
3 26E34C2301000008A ROOM-1 983.00 hPa Yes Yes Yes Yes OK
4 26DC5AC500000048 ROOM-2 0.68 % SLux ALI Yes Yes No Yes OK
5 290A1D160000004D ROOM-3 00 DO Yes Yes No No OK
6 26BF5323010000CA ROOM-4 650.00 ppm CO2 Yes Yes No Yes OK
7 2810174001000023 ROOM-4 27.06 °C ALI Yes Yes No Yes OK
Module address [1-247] 64
COM port COM6
Baudrate 9600 bps
Data bits 8 bitów
Parity None-Brak
Stop Bits 1-Bit Stopu
Timeout [ms] 5000
MODBUS function 0x03
Sound alarm for value VL and VH of measures
1-WIRE diagnostic
D0: No short circuit on 1-WIRE bus.
D1: Found DS sensors.
D2/3: 3-conductor 1-WIRE bus.
D4: Communication on 1-WIRE bus OK
D5: Found 1-WIRE bus controler.
Monitoring
MODBUS communication log
Delete Log
Save Log
For Help, press F1
NUM

Fig 14b. View of MODBUS monitoring window – work parameters of channels

6.3.1. CONFIGURATION OF MODBUS-RTU COMMUNICATION

MODBUS Monitoring *window has options for configuration of MODBUS-RTU communication:*

Module Address [1-247] - enter the address of **ADA-401WP** module for MODBUS-RTU protocol.
COM Port - setted in window **Communication.**
Baud rate - to set the baud rate for each module.

Data bits - not selectable.
Parity - set the type of parity control in data format.
Stop Bits - set the number of stop bits in data format.
Timeout - set the timeout in ms.
MODBUS function - set the function for MODBUS-RTU protocol, for communication with ADA-401WP module.

6.3.2. MODULE MONITORING- MODBUS-RTU

MODBUS Monitoring has options for MODBUS-RTU communication:

Monitoring bottom

Pressing this button will cause readout of:

a) configuration parameters of measurement channels like: Sensor S/N, Location, Val. Lo, Val. Hi, Offset, Enable, Assigned,

b) channel diagnostics like: measurement value, status of measurement channel (U.m., V<VL, V>VH, Enable, Assigned, Busy, Deleted, CRC).
Pressing the button **Monitoring** again, interrupt the monitoring.

MODBUS communication Log
This section is additional element of diagnostic MODBUS-RTU protocol, where frames of inquiry and respond come out during measurement monitoring and status of measurement channels are being written.

Table **MODBUS Monitoring** has columns**:**

Channel - the number of measuring channel.
Sensor SN - serial number of detected sensor.
Location - place of sensor's installation.
Val. Lo - low limit of measuring value. If the value measured by sensor will be lower, that will be setted the byte of exceed lower threshold **V<VL** in the register of measurement channel.
Val. Hi - upper limit of measuring value. If the value measured by sensor will be higher, that will be setted the byte of exceed upper threshold **V>VL** in the register of measurement channel.
Offset - value by which will be increased or decreased measured value of measurement for the linear calibration of the measurement. Offset value depends on sensor type and is:
- from – 1.27°C to +1.27°C for digital temperature sensors: DTS-RJ45, DTS-103, DTS-107, DES-216, DES-300-T, DES-300E-T etc.,
- from -12.70%Hig to +12.70%Hig for digital relative humidity sensors: DES-216-H, DES-300-H etc.,
- from -12.70hPa to +12.70hPa for digital atmospheric pressure sensors: DES-216-AP, DES-300-AP etc.

Enable - activation this field will cues actualisation of measurement and status for channel, deactivation will cues block actualisation.
Assigned - activation this field will cues adding a sensor to the Channel. Deactivation will cues that in case of next sensors searching by the module in field [Sensor SN] channel can be serial number or other sensor.
Progress - horizontal indicator of measuring progression.
Value - measurement value readout from the sensor.
U.m. - unit of measurement, measured by the sensor.
V<VL - indicates that the value readout from the sensor is short then the lower limit of the value **VL**.
V=>VH - indicates that the value readout from the sensor is equal to the lower limit of the value **VH**
Enable - indicates that the measuring channel is unblocked and measuring data and the channel condition are being updating systematically.
Assigned - indicates that sensor of serial number was assigned to measuring channel.
Busy - indicates that sensor is processing data.
Detected - indicates that the sensor of serial number from field **Sensor SN** was detected.
CRC - indicates error of CRC sensor memory or connection error.

Readout of MODBUS registers for columns: **Sensor SN, Location, Val. Lo, Val. Hi, Offset, Enable, Assigned – is available from 2,005 version of firmware and from 1.7.1.0 version of ADAUtil software.**

In this table the status of measuring channel are shown by use the colours as follows:
Field **[Value]**
Red – alarm status of channel, exceed thresholds VH.
Blue - alarm status of channel, exceed thresholds VL.
Green – standard status of measuring channel.

Field **[V<VL], [V>VH], [Enable], [Assigned], [Busy], [Detected], [CRC]**
Yellow – alarm status of field in measuring channel
White – standard status of field in measuring channel

7. IMPLEMENTATION OF MODBUS-RTU PROTOCOL

ADA-401WP module is a like node for the 1-wire network. Each node can be addressed and connected to RS485 bus, and this allow working together many dispersed 1-WIRE networks, with remote control system e.g. temperature, humidity, atmospheric pressure CO_2 concentration, etc. RS485 bus can be extended on lengths of 1200m, by using the ADA-4040 repeater or ADA-4044H RS485 HUB.
The MODBUS-RTU protocol used for communication between ADA-401WP modules and SCADA type system or PLC controller

enable easy integration of 1-wire sensors with existing automation systems.
Extended implementation of the MODBUS-RTU protocol is available by contacting the service department.

7.1. TABLE OF MODBUS-RTU ADDRESSES

7.1.1. MODBUS REGISTERS MEASURING CHANNELS READOUT BY FUNCTION 04 (3X – REFERENCES) INPUT REGISTERS OR FUNCTION 03 (4X – REFERENCES) HOLDING REGISTERS

Address 3X (F04)	*Address 4X (F03)*	*Number of measuring channel*	*Data address for measuring channel*	*Data description*	*Attribute*	*Value*
Measurement value for measuring channels						
30001	40001	0	0	Measurement value	R	16-bit register
30002	40002	1	1	Measurement value	R	16-bit register
30003	40003	2	2	Measurement value	R	16-bit register
30004	40004	3	3	Measurement value	R	16-bit register
30005	40005	4	4	Measurement value	R	16-bit register
30006	40006	5	5	Measurement value	R	16-bit register
30007	40007	6	6	Measurement value	R	16-bit register
30008	40008	7	7	Measurement value	R	16-bit register
30009	40009	8	8	Measurement value	R	16-bit register
...	...	...	...	...	...	
30064	40064	63	63	Measurement value	R	16-bit register
Measuring Channel condition						
30201	40201	0	200	Channel condition	R	16-bit register
30202	40202	1	201	Channel condition	R	16-bit register
30203	40203	2	202	Channel condition	R	16-bit register
30204	40204	3	203	Channel condition	R	16-bit register
30204	40204	4	204	Channel condition	R	16-bit register
30206	40206	5	205	Channel condition	R	16-bit register
30207	40207	6	206	Channel condition	R	16-bit register
30208	40208	7	207	Channel condition	R	16-bit register
30209	40209	8	208	Channel condition	R	16-bit register
...	...	...	...	...	...	
30264	40264	63	263	Channel condition	R	16-bit register
Readout the serial number circuit The serial number is 8-bytes B0, B1 ... B7						
30401	40401	0	400	serial number SN-C00-B0-B1	R	16-bit register
30402	40402	0	401	serial number SN-C00-B2-B3	R	16-bit register
30403	40403	0	402	serial number SN-C00-B4-B5	R	16-bit register
30404	40404	0	403	serial number SN-C00-B6-B7	R	16-bit register
30405	40405	1	404	serial number SN-C01-B0-B1	R	16-bit register
30406	40406	1	405	serial number SN-C01-B2-B3	R	16-bit register
30407	40407	1	406	serial number SN-C01-B4-B5	R	16-bit register
30408	40408	1	407	serial number SN-C01-B6-B7	R	16-bit register
...	...	...	...	...	...	...
30653	40653	63	652	serial number SN-C63-B0-B1	R	16-bit register
30654	40654	63	653	serial number SN-C63-B0-B1	R	16-bit register
30655	40655	63	654	serial numberSN-C63-B0-B1	R	16-bit register

Address 3X (F04)	Address 4X (F03)	Number of measuring channel	Data address for measuring channel	Data description	Attribute	Value
30656	40656	63	655	serial number SN-C63-B0-B1	R	16-bit register

7.2. FRAME STRUCTURE OF MODBUS-RTU PROTOCOL

Device address (1-byte)	Function (1-byte)	Data (n-bytes)	CRC-16Lo (1-byte)	CRC-16Hi (1-byte)

7.3. USED FUNCTIONS OF MODBUS-RTU PROTOCOL

Function code	Description
03 (0x03)	Readout of measurement value and measuring channel condition
04 (0x04)	Readout of measurement value and measuring channel condition

7.3.1. READOUT OF THE VALUES FROM THE MEASUREMENT CHANNELS

7.3.1.1. FUNCTION 0x03 / 0x04 – READOUT OF TEMPERATURE FROM MEASURING CHANNEL [4X / 3X-REFERENCES]

Function 0x03 / 0x04 are used for readout of the value from measuring channel (sensor).
The mesurement value from measuring channel (sensor) is presented by a 16-bit register.
The registers with measuring value are in the format of 16-bit signed integer (C/C++ type short int).

The real value of temperature in °C (-55 – +125 [°C]) obtained from the read register according to below algorithm by use appropriate factor value **DW=100** (table below):

Measured/ adjusted Value	Unit of measurement	DW factor value	Measured/ adjusted Value	Unit of measurement	DW factor value
Temperature	°C	100	PT1000 sensor's temperature	°C PT1000	10
Relative humidity	%RH	10	0-10VDC transducer	V U10	100
Lighting (natural or unnatural)	%Lux	10	0-20mADC transducer	mA A20	100
Sunlight	%SLux	10	Circuit DS2401 serial number	S/N	non
Temperature adjuster	(TA)°C	10			
Percentage adjuster	(PA)%	10			
Atmospheric pressure	hPa	10			
CO2 concentration (in preparation)	CO2 ppm	1			
PT100 sensor's temperature	°C PT100	10			
PT500 sensor's temperature	°C PT500	10			

Algorithm 1. Readout register is saved to regular type variable (float) and then divide it by the factor **DW**

```
// Fragment of code in C language (VS6.0) presenting above algorithm
short int siMeasurementReg;
float      fMeasurmentValue
......
fMeasurmentValue = (float)siMeasurementRegister;
fMeasurmentValue = fMeasurmentValue / DW;
```

Algorithm 2. Readout register is saved to regular type variable 16-bit (short int) and then divide by the factor **DW**, received change of the dividing it is a number of the hundredth parts of the measurement value.

```
// Fragment of code in C language (VS6.0) presenting above algorithm
short int siMeasurementReg;
div_t     div_MeasurmentValue;
......
div_MeasurmentValue = div((int)siMeasurementRegister, DW)
printf( "Total measurement value =  %d\n, hundredth parts of the measurement value = %d\n",
          div_MeasurmentValue.quot, div_MeasurmentValue.rem );
```

Query

Byte no	Designation	Size	Value [hex]
00	Module address	1 byte	**01 [01 to F7]**
01	Function code	1 byte	**03 / 04**
02	Registry address Hi	1 byte	**00**
03	Registry address Lo	1 byte	**00**

Byte no	*Designation*	*Size*	*Value [hex]*
04	Registry number Hi	1 byte	**00**
05	Registry number Lo	1 byte	**02**
06	CRC-Lo	1 byte	**---**
07	CRC-Hi	1 byte	**---**

Example. Temperature readout form two channels (address 40001 to 40002 / address 30001 to 30002)

01-03-00-00-00-02-CRCLo-CRCHi
01-04-00-00-00-02-CRCLo-CRCHi

Response

Byte no	*Designation*	*Size*	*Value [hex]*
00	Module address	1-byte	**01 [01 to F7]**
01	Function code	1-byte	**03 / 04**
02	Number of data bytes	N-byte	**04 [depend on inquiry(4)]**
03	Data1-Hi	1-byte	**09**
04	Data1-Lo	1-byte	**60**
05	Data2-Hi	1-byte	**09**
06	Data2-Lo	1-byte	**92**
07	CRC-Lo	1-byte	**---**
08	CRC-Hi	1-byte	**---**

Example. Temperature readout from (address 40001 to 40002 / address 30001 to 30002)

01-03-04-09-60-09-92-CRCLo-CRCHi
01-04-04-09-60-09-92-CRCLo-CRCHi

In respond channels temperature from 0 to 1 is presented as 4-byte with values:
- channel_0 = 0x0960 => 2400/100 => 24,00°C
- channel_1 = 0x0992 => 2450/100 => 24,50°C

Response - in case of error

Byte no	*Designation*	*Size*	*Value [hex]*
00	Module address	1-byte	**01 [01 do F7]**
01	Function code	1-byte	**83 / 84**
02	Error code	1-byte	**01 - unknown function** **02 - unknown data address** **03 - unknown data value** **04 - unknown error during inquiry converting**
03	CRC - Lo	1-byte	
04	CRC - Hi	1-byte	

7.3.1.2. FUNCTION 0x03 / 0x04 – READOUT OF RELATIVE HUMIDITY FROM MEASURING CHANNEL [4X / 3X-REFERENCES]

Function 0x03 / 0x04 are used for readout of the value from measuring channel (sensor).
The value from measuring channel (sensor) is presented by a 16-bit register.
The registers with measuring value of relative humidity are in the format of 16-bit signed integer (C/C++ type short int).

The actual value of relative humidity in percent (0 – 100 [%RH]) is obtained from readout register according to algorithm from paragraph 7.3.1.1 by use appropriate factor value **DW=10** (table p.7.3.1.1).

7.3.1.3. FUNCTION 0x03 / 0x04 – READOUT OF ATMOSPHERIC PRESSURE FROM MEASURING CHANNEL [4X / 3X-REFERENCES]

Function 0x03 / 0x04 are used for readout of the value from measuring channel (sensor).
The value from measuring channel (sensor) is presented by a 16-bit register.
The registers with measuring value of atmospheric pressure are in the format of 16-bit signed integer (C/C++ type short int).

The actual value of atmospheric pressure in hPa (150 – 1150 [hPa]) is obtained from readout register according to algorithm from paragraph 7.3.1.1 by use appropriate factor value **DW=10** (table p.7.3.1.1).

7.3.1.4. FUNCTION 0x03 / 0x04 – READOUT OF LIGHTING FROM MEASURING CHANNEL [4X / 3X-REFERENCES]

Function 0x03 / 0x04 are used for readout of the value from measuring channel (sensor).
The value from measuring channel (sensor) is presented by a 16-bit register.
The registers with measuring value of lighting are in the format of 16-bit signed integer (C/C++ type short int).

The actual value of lighting in percent % (0 – 100 [%Lux]) is obtained from readout register according to algorithm from paragraph 7.3.1.1 by use appropriate factor value **DW=10** (table p.7.3.1.1).

7.3.1.5. FUNCTION 0x03 / 0x04 – READOUT OF SUNLIGHT FROM MEASURING CHANNEL [4X / 3X-REFERENCES]

Function 0x03 / 0x04 are used for readout of the value from measuring channel (sensor).
The value from measuring channel (sensor) is presented by a 16-bit register.
The registers with measuring value of sunlight are in the format of 16-bit signed integer (C/C++ type short int).

The actual value of sunlight in percent % (0 – 100 [%SLux]) is obtained from readout register according to algorithm from paragraph 7.3.1.1 by use appropriate factor value **DW=100** (table p.7.3.1.1).

7.3.1.6. FUNCTION 0x03 / 0X04 – READOUT OF TEMPERATURE SET IN TEMPERATURE ADJUSTER FROM MEASURING CHANNEL [4X / 3X-REFERENCES]

Function 0x03 / 0x04 are used for readout of the value from measuring channel (sensor).
The value from measuring channel (sensor) is presented by a 16-bit register.
The registers with value of temperature set by the adjuster are in the format of 16-bit signed integer (C/C++ type short int).

The actual value of temperature set by the use of temperature adjuster in °C (5 – 40 [TA(°C)]) is obtained from readout register according to algorithm from paragraph 7.3.1.1 by use appropriate factor value **DW=10** (table p.7.3.1.1).

7.3.1.7. FUNCTION 0x03 / 0X04 – READOUT OF PERCENTAGE VALUE SET IN PERCENT ADJUSTER FROM MEASURING CHANNEL [4X / 3X-REFERENCES]

Function 0x03 / 0x04 are used for readout of the value from measuring channel (sensor).
The value from measuring channel (sensor) is presented by a 16-bit register.
The registers with percent value set by the adjuster are in the format of 16-bit signed integer (C/C++ type short int).

The actual value set in percent adjuster in percent % (0 – 100 [PA(%)]) is obtained from readout register according to algorithm from paragraph 7.3.1.1 by use appropriate factor value **DW=10** (table p.7.3.1.1).

7.3.1.8. FUNCTION 0x03 / 0x04 – READOUT OF CO2 CONCENTRATION MEASURING CHANNEL [4X / 3X-REFERENCES]

Function 0x03 / 0x04 are used for readout of the value from measuring channel (sensor).
The value from measuring channel (sensor) is presented by a 16-bit register.
The registers with measuring value of CO2 concentration are in the format of 16-bit signed integer (C/C++ type short int).

The actual value of CO2 concentration in ppm (350 – 10000 [ppm]) is obtained from readout register according to algorithm from paragraph 7.3.1.1 by use appropriate factor value **DW=1** (table p.7.3.1.1).

7.3.1.9. FUNCTION 0x03 / 0x04 – READOUT OF TEMPERATURE VALUE OF SENSOR PT100 , PT500, PT1000 FROM MEASURING CHANNEL [4X / 3X-REFERENCES]

Function 0x03 / 0x04 are used for readout of the measurement value from measuring channel (DES-216-PT transducer).
The measurement value from measuring channel (DES-216-PT transducer) is presented by a 16-bit register.
The registers with measurement value of temperature from transducer PT100, PT500, PT1000 are in the format of 16-bit signed integer (C/C++ type short int).

The actual value of measurement value of temperature from DES-216-PT transducer in °C (-200 – +600 [°C PT100] is obtained from readout register according to algorithm from paragraph 7.3.1.1 by use appropriate factor value **DW=10** (table p.7.3.1.1).

7.3.1.10. FUNCTION 0x03 / 0x04 – READOUT OF VOLTAGE VALUES 0-10V DC FROM MEASURING CHANNEL [4X / 3X-REFERENCES]

Function 0x03 / 0x04 are used for readout of the measurement value from measuring channel (DES-216-U transducer).
The measurement value from measuring channel (DES-216-U transducer) is presented by a 16-bit register.
The registers with measurement voltage values from DES-216-U transducer, are in the format of 16-bit signed integer (C/C++ type short int).

The actual value of measurement value of voltage from DES-216-U transducer in VDC (0 – 10 [V U10] is obtained from readout register according to algorithm from paragraph 7.3.1.1 by use appropriate factor value **DW=100** (table p.7.3.1.1).

7.3.1.11. FUNCTION 0x03 / 0x04 – READOUT OF AMPERAGE VALUES 0-20mA DC FROM MEASURING CHANNEL [4X / 3X-REFERENCES]

Function 0x03 / 0x04 are used for readout of the measurement value from measuring channel (DES-216-I transducer).
The measurement value from measuring channel (DES-216-I transducer) is presented by a 16-bit register.
The registers with measurement amperage values from DES-216-I transducer, are in the format of 16-bit signed integer (C/C++ type short int).

The actual value of measurement value of amperage from DES-216-I transducer in mA DC (0 – 20 [mA A20] is obtained from readout register according to algorithm from paragraph 7.3.1.1 by use appropriate factor value **DW=100** (table p.7.3.1.1).

7.3.2. FUNCTION 0X03 / 0X04 - READOUT OF CIRCUIT SERIAL NUMBER FROM MEASURING CHANNEL [4X / 3X-REFERENCES]

Use function code 0x03 / 0x04 for readout of 1-WIRE circuit serial number from measuring channel.
In case of query not the whole serial number, the module will respond the exception 2 - unknown address data.
The serial number in measuring channel is presented by four 16-bit registers.
Example of the circuit serial number (hex) : 26 10 17 40 01 00 00 23 will be saved in the MODBUS register like in the table below.

Channel	*Register address (dec)*	*Hi Register Contents*	*Lo Register Contents*
0	400	Byte 0 of serial number 26	Bajt 1 of serial number 10
0	401	Byte 2 of serial number 17	Bajt 3 of serial number 40
0	402	Byte 4 of serial number 01	Bajt 5 of serial number 00
0	403	Byte 6 of serial number 00	Bajt 7 of serial number 23

Query of circuit serial number from channel nr 0 .

Byte no	*Designation*	*Size*	*Value [hex]*
00	Module address	1 Byte	**01 [01 to F7]**
01	Function code	1 Byte	**03 / 04**
02	Registry address Hi	1 Byte	**01**
03	Registry address Lo	1 Byte	**90**
04	Registry number Hi	1 Byte	**00**
05	Registry number Lo	1 Byte	**04**
06	CRC-Lo	1 Byte	**---**
07	CRC-Hi	1 Byte	**---**

Example. Readout of circuit serila number from measuring channel nr.0 (address 40401 to 40404 / address 30401 to 30404)

01-03-01-90-00-04-CRCLo-CRCHi
01-04-01-90-00-04-CRCLo-CRCHi

Response

Byte no	*Designation*	*Size*	*Value [hex]*
00	Module address	1-Byte	**01 [01 to F7]**
01	Function code	1-Byte	**03 / 04**
02	Number of data bytes	N-Byte	**08 [dependent on query]**
03	S/N0-Hi	1-Byte	**26**
04	S/N1-Lo	1-Byte	**10**
05	S/N2-Hi	1-Byte	**17**
06	S/N3-Lo	1-Byte	**40**
07	S/N4-Hi	1-Byte	**01**
08	S/N5-Lo	1-Byte	**00**
09	S/N6-Hi	1-Byte	**00**
10	S/N7-Lo	1-Byte	**23**
11	CRC-Lo	1-Byte	**---**
12	CRC-Hi	1-Byte	**---**

Example. Readout of circuit serila number from channel nr.0 (address 40401 to 40404 / address 30401 to 30404)

01-03-08-26-10-17-40-01-00-00-23-CRCLo-CRCHi
01-04-08-26-10-17-40-01-00-00-23-CRCLo-CRCHi

In the response circuit serial number from channel 0: **26-10-17-40-01-00-00-23**

Response – in case of error

Byte no	*Designation*	*Size*	*Value [hex]*
00	Module address	1-Byte	**01 [1 to F7]**
01	Function code	1-Byte	**83 / 84**
02	Error code	1-Byte	**01 - unknown function** **02 - unknown data address** **03 - unknown data value** **04 - unknown error while inquiry converting**
03	CRC-Lo	1-Byte	
04	CRC-Hi	1-Byte	

7.3.3. FUNCTION 0X03 / 0X04 - READOUT OF MEASURING CHANNEL STATUS [4X / 3X-REFERENCES]

Use function code 0x03 / 0x04 for readout of measuring channel status.
The condition of each measuring channel is presented by 16-bit register:

Register of the measuring channel status

Bit	*Channel status Byte Lo*	*Bit*	*Channel status Byte Hi (from ver.1.008 firmware)*
0	**Sensor in processing** 0 - No 1 - Yes	**0**	**Short circuit on the 1-Wire bus** 0 - No 1 - Yes
1	**Sensor detected** 0 - No 1 - Yes	**1**	**DS18xx circuit present on 1-WIRE bus** (0) 0 - No 1 - Yes
2	**Channel unlocked** 0 - No 1 - Yes	**2**	**Additional power (3-wire bus)** 0 - No **1 - Yes**
3	**Overflow the lower threshold of measure value V<VL** 0 - No 1 - Yes	**3**	**Parasite Mode (2-wire bus)** 0 - No **1 - Yes**
4	**Overflow the high threshold of measure value V≥VH** 0 - No 1 - Yes	**4**	**1-WIRE communication errors** 0 - No **1 - Yes**
5	**Sensor assigned to channel** 0 - No 1 - Yes	**5**	**DS2480B controller detected** 0 - No **1 - Yes**
6	**Reserved** 0 - No 1 - Yes	**6**	**Reserved** (0) 0 - No 1 - Yes
7	**Error CRC Scratchpad of sensor** 0 - No 1 - Yes	**7**	**Reserved** (0) 0 - No 1 - Yes

Query

Byte no	*Designation*	*Size*	*Value [hex]*
00	Module address	1 byte	**01 [01 to F7]**
01	Function code	1 byte	**03 / 04**
02	Registry address Hi	1 byte	**00**
03	Registry address Lo	1 byte	**C9**
04	Registry number Hi	1 byte	**00**
05	Registry number Lo	1 byte	**02**
06	CRC - Lo	1 byte	**---**
07	CRC - Hi	1 byte	**---**

Example. 2 channels status readout (address 40201 to 40202 / address 30201 to 30202)

01-03-00-C9-00-02-CRCLo-CRCHi
01-04-00-C9-00-02-CRCLo-CRCHi

Response

Byte no	*Designation*	*Size*	*Value [hex]*
00	Module address	1-byte	**01 [01 to F7]**
01	Function code	1-byte	**03 / 04**
02	Number of data bytes	N-byte	**04 [depend on inquiry (4)]**
03	Status 1-Hi	1-byte	**00**
04	Status 1-Lo	1-byte	**01**
05	Status 2-Hi	1-byte	**00**
06	Status 2-Lo	1-byte	**02**
07	CRC - Lo	1-byte	**---**
08	CRC - Hi	1-byte	**---**

Example. 2 channels status readout (address 40201 to 40202 / address 30201 to 30202)

01-03-04-00-01-00-02-CRCLo-CRCHi
01-04-04-00-01-00-02-CRCLo-CRCHi

In respond channel status 0 to 1 is present as 4-byte with value:
- channel_0 hi = 00, lo = 01 – sensor during converting
- channel_1 hi = 00, lo = 02 – detection of sensor

Response - in case of error

Byte no	*Designation*	*Size*	*Value [hex]*
00	Module address	1-byte	**01 [1 to F7]**
01	Function code	1-byte	**83 / 84**
02	Error code	1-byte	**01 - unknown function** **02 - unknown data address** **03 - unknown data value** **04 - unknown error while inquiry converting**
03	CRC - Lo	1-byte	
04	CRC - Hi	1-byte	

8. SPECIFICATION

TECHNICAL DATA		
Transmission Parameters		
Interface	**RS-485**	**1-WIRE**
Connector	Screw terminal, wire max. Ø 2,5mm^2.	Screw terminal, wire max. Ø 2,5mm^2.
Line length	1200 m	Up to 300 m depends on 1-Wire bus and used cables
Maximum number of connected device	32 devices	64 sensors
Maximum baud rate	Up to 230,4 kbps	standard: up to 16,3 kbps,
Transmission line	2-pair twisted cable eg UTP 4x2x0,5(24AWG), shield inside large interferences eg STP 4x2x0,5(24AWG)	1-pair, 2-pair twisted cable eg UTP 4x2x0,5(24AWG), shield inside large interferences eg STP 4x2x0,5(24AWG)
Transmission type	RS485/RS422 MODBUS - halfduplex (inquiry - response)	fullduplex (sending and receiving on the same wire)
Standards	1-WIRE, EIA-485, CCITT V.11.	
Optical Signalization	• PWR – green LED power supply, • RX - red LED data receiving through 1-WIRE interface, • TX - yellow LED data transmission through 1-WIRE interface	

Accuracy and range of measurement	
Measurement range of sensors	Specified in the instructions of sensors.
Measurement accuracy of sensors	Specified in the instructions of sensors.
Electrical Parameters	
Power requirements	10 - 24 – 30 V DC
Power cable	Recommended length of power cable < 3m
Power	3W
Protection from reverse power polarization	YES
Galvanic isolation	3kV DC between power circuit and signal line RS-485
Optoisolation	~ 3kV between 1-WIRE signal line and RS-485
Electromagnetic compatibility	Resistance to disruptions according to the standard PN-EN 55024. Emission of disruptions according to the standard PN-EN 55022.
Safety requiring	According to the PN-EN60950 norm.
Environment	Commercial and light industrial.
Environmental Parameters	
Operating temperature	-30 ÷ 60°C
Humidity	5 ÷ 95% - non-condensing
Storage temperature	-40 ÷ 70 °C
Casing	
Dimensions	53 x 90 x 62 mm
Material	ABS / PC (self-extinguishing)
Degree of casing protection	IP40
Degree of terminal protection	IP20
Weight	0,10 kg
According to standard	DIN EN50022, DIN EN43880
Location during work	Free
Mounting method	On the rail compliant with DIN35 / TS35 standard.

Dear Customer,

Thank you for purchasing **CEL-MAR** Company product.

We hope that the **ADA-401WP module** and this user manual help simplify your network of 1-Wire sensor for industrial applications. We also wish to remind you that CEL-MAR Company are a manufacturer of the widest selections of data communications products in the world in applications such as: data transmission converters in RS232, RS485, RS422, USB, Current Loop, Fibre-Optic and Ethernet Converters and many others.
We welcome your feedback so please contact us to tell how you like our products and how we can satisfy you present and future needs.

CEL-MAR sp.j.
Department of IT and Electronics
Sciegiennego 219C, str.
25-116 Kielce, POLAND

Tel: +48 41 362-12-46
Tel/fax: +48 41 361-07-70
Web: http://www.cel-mar.pl
Office: office@cel-mar.pl
Sales department: sales@cel-mar.pl
Technical information: support@cel-mar.pl